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ABSTRACT

This manual, a self-study guide for apprentices in the drywall finishing trade in British Columbia, attempts to establish standards for the trade. It tells how to produce a properly taped and filled drywall surface and describes what that surface should look like. The standards emphasize quality work that can be realistically achieved on the job. Wherever possible the manual divides aspects of drywall finishing into step-by-step procedures. Safe, efficient use of the body in performing finishing tasks is stressed in the procedures. Besides procedures, the manual also deals with knowledge related to drywall finishing. The manual consists of 11 modules covering the following topics: filling compounds, safety, applying bead, taping and wiping tapes, filling, texturing, repairs and corrections, factors affecting drywall finishing, working efficiently, maintenance of tools and machines, and estimating. Each module contains an introduction that describes the contents of the module; an information section illustrated with tables, line drawings, and photographs; a summary; and exercises. An answer key completes the manual. (KC)

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Drywall Finishing Manual

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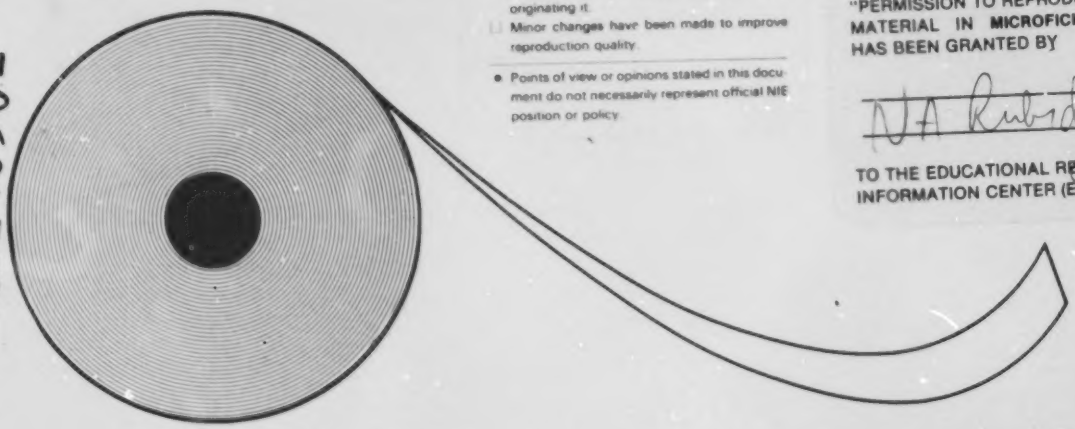

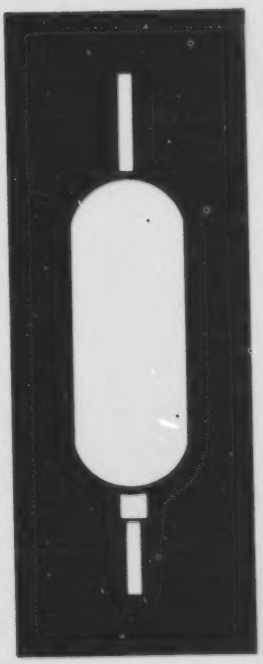

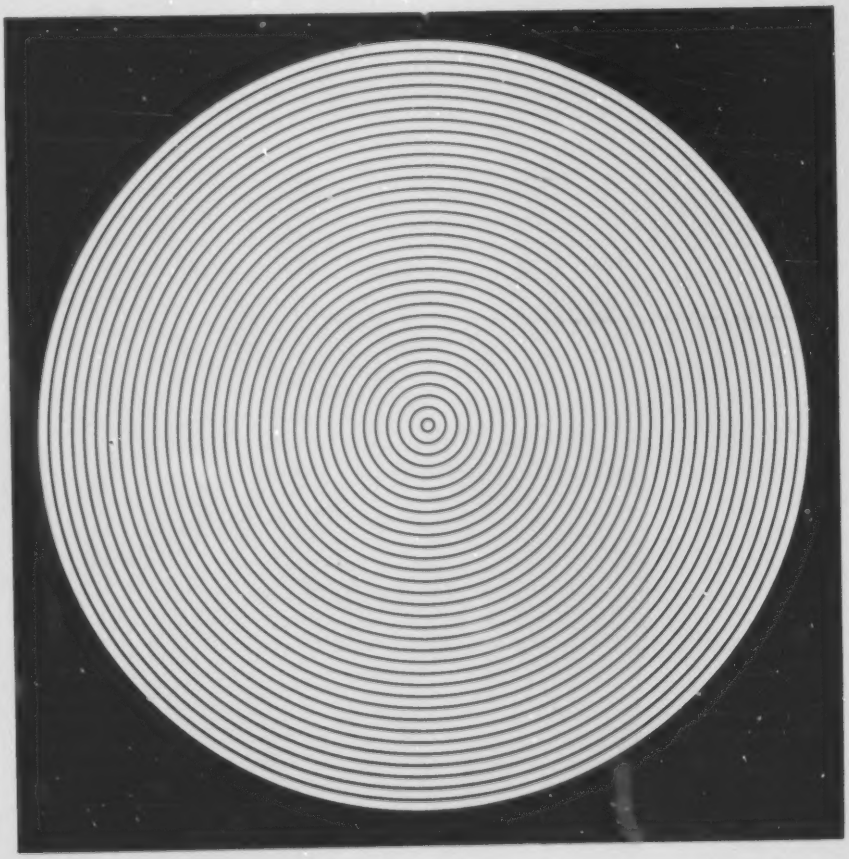

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Introduction

This manual attempts to establish standards for the drywall finishing trade. It tells how to produce a properly taped and filled drywall surface and describes what that surface should look like. The standards emphasize good quality work that can be realistically achieved on the job.

Wherever possible the manual divides aspects of drywall finishing into step by step procedures. For example, four procedures are given for applying the first filling coat to a butt joint. These procedures provide the basis for a finisher to master and build upon to become a competent tradesman. Safe, efficient use of the body in performing finishing tasks is always a concern in the procedures.

Besides procedures, the manual also deals with knowledge related to drywall finishing. Filling compounds and beads are discussed, as are the use and maintenance of tools and the effects that temperature, humidity, and ventilation have on drying fillers. The knowledge is not an extra or a frill; it has practical applications to the day to day work done by finishers.

After studying a module, you should do the exercise located at the end of each module to see what you have learned. Answers to the exercises are provided at the end of the manual. "Sleuth Sheets" are given in the taping and the filling modules to help you solve problems in your finishing work.

Contents

Module 1: **Filling Compounds**

Introduction. **1**
General Characteristics of Filling Compounds. **1**
Filler Formulations. **2**
Fillers in Filling Compounds. **3**
Casein Slow-set Filler. **5**
Vinyl Slow-set Filler. **5**
Pre-mix Fillers. **6**
Fast-set Filler. **7**
Water Absorption and Drying. **8**
Filler Problems Related to Moisture and Drying. **9**
Mixing Fillers. **10**
Definitions Related to Filling Compounds. **11**
Summary. **11**
Exercise. **12**

Module 2: **Safety**

Introduction. **13**
Injuries Common to Drywall Finishers. **13**
Minimum Stress Trowelling Techniques. **15**
Minimum Stress Techniques with Taping Machines. **16**
Safe Practice with Stilts and Scaffolds. **17**
Constructing Safety Railings. **18**
Working with Ladders. **18**
Safety Precautions with Floors. **19**
Electrical Equipment Precautions. **19**
Pressurized Equipment Precautions. **20**
Dust Protection. **20**
Eye Protection. **21**
Noxious Fume Protection. **21**
Hearing Protection. **22**
Head Protection. **22**
Summary. **22**
Exercise. **22**

Contents

Module 3: **Applying Bead**

Introduction. **23**
Beads. **23**
Edge Trims. **26**
Other Beads and Trims. **30**
Measuring and Cutting Beads and Trims. **30**
Plumb, Level and Straight. **35**
Attaching Metal Corner Bead. **36**
Attaching Glue-on Beads. **39**
Summary. **42**
Exercise. **43**

Module 4: **Taping and Wiping Tapes**

Introduction. **45**

Hand Taping. 47
Tape. 47
Pre-Filling. **47**
Dry Method Hand Taping. **47**
Dry Taping Butt Joints. **49**
Dry Taping Flats. **50**
Applying Short Tapes. **51**
Dry Taping Angles. **52**
Cleanup Procedures. **53**
Hopper Method Hand Taping. **54**
Hopper Taping Walls. **56**
Hopper Taping Ceilings. **57**
Hopper Taping Sleuth Sheet. **59**
Banjo Method Hand Taping. **59**
Exercise. **60**

Machine Taping. 63
Tools. **64**
Loading Rolls of Tape. **64**
Filling a Taping Machine. **66**
Rinsing the Machine Head. **68**
Taping Sequence for Machines. **68**
Procedures with a Newly Filled Bazooka. **69**
Basic Procedures for Machine Taping Joints. **69**
Jammed Blades. **72**
Short Tapes with Machines. **73**
Taping Machine Holding Positions. **73**
Keypoints with Taping Machines. **75**
Machine Taping Closets. **75**
Machine Taping Valances. **76**
Cleaning a Taping Machine. **76**

Bazooka Courtesies. 77
Machine Taping Sleuth Sheet. 78
Exercise. 81

Wiping Tapes. 83
Hand Wiping Tools. 83
General Points on Wiping. 84
Wiping Sequence. 86
Wiping Butt Joints. 87
Eliminating Wrinkles. 88
Wiping Flats. 89
Wiping Short Tapes. 89
Wiping Angles by Hand. 90
Rolling Angles. 92
Flushing Angles. 93
Wiping Angle Bottoms. 94
Wiping Threeways. 94
Wiping Non 90° Angles. 96
Cleanup after Wiping. 98
Wiping Butts and Flats Sleuth Sheet. 99
Wiping Angles Sleuth Sheet. 101
Exercise. 104

Module 5: **Filling**

Introduction. 105
The Right Filler for the Job. 105
Pre-filling. 106
Telling if Filler is Dry. 107
Types of Filler Coats. 108
Holding a Knife for Filling. 111
Holding a Trowel for Filling. 111
Basic Filling Passes (or Strokes). 112
Joining Wet Filler. 114
Rough Sanding. 114
Filling Vertical Bead. 115
Filling Horizontal Bead. 118
Filling Narrow, Parallel Beads. 118
Filling Intersecting Beads. 119
Filling Butt Joints. 122
Filling Butt Joints on Curved Surfaces. 123
Filling Flats on Curved Surfaces. 125
Filling Uneven Butt Joints. 125
Filling Flats. 126
Filling Butts and Flats with Machines. 127
Filling Machines (Boxes). 127
Loading Filling Boxes. 129

Contents

Filling Box Combinations. **130**
Filling Flats with Boxes. **130**
Filling Butts with Boxes. **131**
Filling Ceilings with Boxes. **132**
Filling Fasteners by Hand. **133**
Filling Nails Singly. **135**
Filling Fasteners by Row. **135**
Filling Machines for Fasteners. **136**
Filling Fasteners with a Box. **137**
Filling Angles. **138**
Filling Angles by Hand. **138**
Filling Angles with Machines. **140**
Filling Bottoms and Threeways. **142**
Filling Non 90° Angles. **142**
Filling Rounded Angles. **143**
Tool Cleanup. **145**
Finish Sanding. **145**
Final Inspection. **146**
Summary. **147**
Filling Sleuth Sheet. **151**
Exercise. **153**

Module 6: **Texturing**

Introduction. **157**
Types of Wallboard Texture. **157**
Acoustic Texture. **158**
Glitter. **158**
Surface Preparation. **158**
Design Layouts. **159**
Using Color. **162**
Masking. **164**
Undercoating. **165**
Airless Paint Machines. **167**
Texture Machines. **169**
Factors Affecting Texture Appearance. **170**
Regulating Texture Appearance. **171**
Texture Spraying Techniques. **172**
Finishing off Ceilings after Texturing. **174**
Hand Texturing. **175**
Summary. **177**
Exercise. **178**

Module 7: **Repairs and Corrections**

Introduction. **179**
Repairing Gouges, Ridges and Other Defects as You Go. **179**
Patching Holes. **182**

Keying Painted Surfaces. **186**
Repairing Previously Finished Wallboard. **186**
Repairing Damaged Plaster. **188**
Repairing Damaged Textures. **189**
Summary. **190**
Exercise. **191**

Module 8: **Factors Affecting Drywall Finishing**

Introduction. **193**
Finish Schedules. **193**
Examples of Finishing Schedules. **196**
Blueprint Written Specifications. **197**
Moisture Content in Wood Framing and Wallboard. **199**
Proper Drying Conditions for Filler. **200**
Checking for Inspection Slip-Ups. **202**
Method of Taping and Filling. **207**
Handling and Storage of Materials. **208**
Protecting Nearby Surfaces. **209**
Summary. **210**
Drying Chart for Joint Filler. **213**
Room Finish Schedule Example 1. **214**
Room Finish Schedule Example 2. **215**
Room Finish Schedule Example 3. **216**
Interior Finish Schedule Example 4. **217**
Exercise. **218**

Module 9: **Working Efficiently**

Introduction. **219**
Organizing Tools and Equipment. **219**
Identifying Cost-Efficient Use of Materials. **220**
Checking Work. **220**
The Individual Versus the Team Approach. **220**
Work Systems. **221**
Summary. **221**
Exercise. **222**

Module 10: **Maintenance of Tools and Machines**

Introduction. **223**
Maintaining Hand Tools. **223**
Maintaining Machines. **225**
Repairing Machines. **226**
Repairing Hoppers and Banjos. **227**
Repairing Taping Machines. **227**
Repairing Angle Rollers and Flushers. **232**
Repairing Filling Boxes. **232**
Repairing Hand and Pole Sanders. **232**

Contents

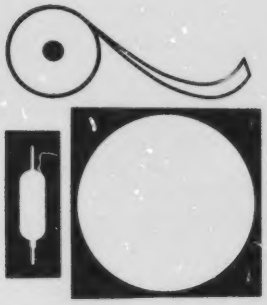
Repairing Airless Paint Sprayers and Texture Machines. **233**
Summary. **233**
Exercise. **234**

Module 11: **Estimating**

Introduction. **236**
Blueprints. **236**
Calculating Areas from Blueprints. **237**
Estimating from the Job Site. **239**
Other Factors when Costing a Job. **241**
Summary. **242**
Exercise. **243**

Answer Key

Module 1. **245**
Module 2. **245**
Module 3. **246**
Module 4:
  Hand Taping. **247**
  Machine Taping. **248**
  Wiping Tapes. **249**
Module 5. **250**
Module 6. **253**
Module 7. **254**
Module 8. **254**
Module 9. **255**
Module 10. **256**
Module 11. **256**



Filling Compounds

MODULE 1

INTRODUCTION

Although drywall finishing is a relatively new trade in the construction industry, fillers are not new compounds. In fact, some filler-like substances are not man-made. Aquatic animals have known the secret of fillers for millions of years; clams, mussels, oysters, crabs, and other shellfish produce compounds for their shells that are similar to drywall fillers.

Both drywall fillers and sea shells are basically limestone and glue. Glues such as polyvinyl acetate, polyvinyl alcohol, and casein are used in drywall fillers in combination with limestone, dolomite, and gypsum. In the oceans these minerals float freely, allowing the shellfish to "mine" them with very little effort. Shellfish secrete glues which mix with the limestone and harden to become their homes. Millions of dollars have been spent to find a binder as suitable for our purposes as the natural binders are for the shellfish. Unfortunately the mollusc hasn't been of much help here as it has clammed up about its formula.

This module discusses basic formulas for drywall fillers, and also discusses what affects the ingredients in fillers have on the work of the drywall finisher. Knowing more about filler, about how it works and what it can and can't do, will help finishers to better use the material and avoid problems with it.

Note that as the demands of the industry change, so do filler formulas. Thus the information here is general and may not always apply to a specific brand.

General Characteristics of Filling Compounds

Drywall filling compounds are more closely related to latex paints than to plaster. Latex paint and drywall filler have the same basic formula and some of the same ingredients. Both latex paints and drywall filling compounds are adhesives in that they rely on a binder or glue to internally bond their ingredients and also to externally bond the material to a surface. When dry, filling compounds exhibit the same characteristics as latex sealers.

Filler is an emulsion; it can be compared to mayonnaise, an emulsion of oil, water, eggs, and vinegar. Oil and water do not mix, but when the other ingredients of mayonnaise are mixed with the oil and water separation does not occur. The same thing happens with filler — the particles are suspended in the water and do not float or settle. This thick emulsion has the property of changing from a semi-solid to a liquid at the point of being sheared or cut with a blade, then returning to a semi-solid immediately after the blade has passed through. This property, called thixotropism, is necessary to produce a smooth surface on a filler with a trowel.

Since filler is cut when worked by a blade, the edges of drywall trowels and knives must be filed to a sharp square so that they can easily cut through the filling compound and not float over it. Note that the opposite is true with plaster. Plastering tools must float over the plaster to make it smooth. If cut, the coarse aggregate in the plaster will cause tears or pulls in the surface.

Filler Formulations

Not many drywall finishers realize what goes into filler, and how accurately the ingredients must be balanced to attain the critical blend of properties necessary to make the filler work properly both during application and after it has dried. Filler is a carefully formulated material. Few other products that cost so little have so much expected of them.

Filling compounds consist of a binder and functional fillers, and are compounded either as a powder, which is mixed with water to the proper consistency before application, or as a pre-mixed paste. Powdered fillers are being phased out by the more convenient pre-mixes.

Important qualities in filling compounds are: minimum slacking-off (thinning) after adding water to powdered filler and letting it stand; minimum slump; easy trowelling, smoothing, and sanding; good tape adhesion; good flexibility; minimum shrinkage; and resistance to edge-cracking. These properties are determined by the type and proportions of binders and fillers and the amount of water added.

It is important to note that manufacturers cannot formulate a filling compound that will match every job condition, nor can they produce a filler that will satsify every finisher's desires. What they can do is formulate for a certain area, climatic condition, or for general expectations of localized finishers. For example, filler applicators in Edmonton prefer a hard surface on their finished product. In Vancouver, finishers prefer a softer, easier-to-sand material. Fillers formulated for the humid conditions in Vancouver will not react the same in the drier conditions in Edmonton and vice versa. This perhaps is why small, local companies specializing in filler often are more successful in meeting the local needs than national companies.

Because of the complexities in formulating filler, it is absurd for a drywall finisher with no training in chemistry and no knowledge of manufacturers' formulations to attempt to mix different fillers to produce a better batch. In fact, the attempt to do so could result in damage claims against the finisher or the employer, and they could not fall back on the manufacturer of the fillers because manufacturers' warranties are cancelled if different fillers are mixed together.

When discussing fillers there are several trade terms that recur:

1. "Water demand" refers to the amount of water a filler requires to make the product workable. Generally, a high water demand is undesirable as it increases shrinkage and the risk of edge-cracking.
2. "Workability" refers to how easily a material smooths out or how much pressure must be put on the blade to cut the filler. Some fillers allow the blade to easily slide over the surface and leave it smooth. Other fillers will stick to the blade, leaving elongated holes called "fish eyes" or a rough surface. The better the workability, the easier the job of the finisher and the faster the work progresses. Poor feathering or thick edges is another indicator of poor workability.

3. "Flexibility" is important in resisting cracking caused by movement of the surface that the filler is applied to.
4. "Slump" refers to how the filler reacts when absorbing water. Vinyl filler generally thins out as it absorbs water.
5. "Open time" is the time that a filler can be worked before it will pull or tear. Open time is the time between the application of the filler on the wall and the formation of a film on the surface of the filler. Once this film is formed, any disturbing of it will cause a tearing of the surface of the filler. The formation of the film is dependent upon the rate of water loss. Therefore, the longer the water is retained the longer the open time of the filler. Loss of water can be retarded by adding fibrous material to the filling compound.

There are four parts found in all unmixed filling compounds: filler, binder, binder modifiers, and additives (Table 1-1). Filler is the bulk of the compound. It is the visible part of the compound after water has been added. Binder holds the filler together and adheres it to the wall. Without a binder the filler would powder and not stick to the wall. Binder modifiers allow the binder to flow among the particles of the filler, congeal the emulsion, and prevent the filler from rotting. Additives give the filling compound desired performance characteristics (Table 1-2). Most additives are trace elements in the formula; there can be as many as 20 of them in a filler.

Table 1-1
Parts of a Filling Compound

Fillers	Binders	Binder Modifiers	Additives
Calcium carbonate (limestone)	Casein (powder)	Dispersants: borax, glycol alcohol, soap	See Table 1-1
Magnesium carbonate (dolomite)	Soya protein (powder)	Plasticizers: carboxy Methyl cellulose, Mica	
Calcium sulphate (gypsum)	Polyvinyl acetate (powder or emulsion)	Preservatives: Mercury compounds	
	Styrene-butadiene (emulsion)		
	Polyvinyl alcohol (powder or solution)		

Fillers in Filling Compounds

The principle ingredient of filling compounds is filler which can be calcium carbonate (limestone), Magnesium carbonate (dolomite), or calcium sulphate (gypsum). Filler supplies the bulk of a filling compound (from 50 to 70 per cent) and keeps down the cost of the compound. Calcium carbonate is the preferred filler because of its low cost, low

el 15

water demand, good workability and desirable color. It has a resistance to shrinkage and edge-cracking and is easily smoothed and sanded. Dolomite has the disadvantage of being a dark color, and calcium sulphate is more expensive than the other fillers and has a higher water demand.

The finer grades of calcium carbonate require higher proportions of water and binder, and are slightly more difficult to work. On the other hand, if the grade is too coarse, the surface finish is not smooth and undesirable grit will be present.

Table 1-2
Filler Additives

Ingredient	Effect
Ammonia	Solvent used to soften casein and enable it to mix with water.
Asbestos	A fibrous talc that provides open time, internal bonding, water retention. Prevents edge-cracking, provides stable viscosity and slickness, and improves sanding. No longer used in filler.
Attapulgite Clay	A fibrous material used as a replacement for asbestos, but does not react chemically the same as asbestos in filler. Has the same morphogenic properties.
Borax	Solvent used to soften casein and enable it to mix with water, but will react with vinyl binders and destroy them. Used in the core of gypsum wallboard to provide air bubbles to lighten sheets.
Carboxy Methyl Cellulose	Promotes workability; wood fibre.
Clay, Talc	Improves sanding but increases water demand and makes material difficult to smooth out.
Glycol Alcohol	Gives open time and smoothness. Also a dispersant when mixing pre-mix fillers.
Mica	Improves workability, flexibility and crack resistance.
Potassium Tri-poly Phosphate	Dispersant. Permits water to mix readily with dry powders.
Silica	Used as a replacement for asbestos; found naturally with calcium carbonate.
Soap	Increases workability, but creates air bubbles when used with attapulgite clay.
Starch	Used to make filler hard, and as a bonding agent.

Calcium carbonate is a mineral and will not decompose when exposed to air. However, if a room is not ventilated properly and if it is heated with propane heaters, a build-up of sulphur dioxide and moisture will create an acidic mixture that will react with the limestone and cause it to discolor.

Casein Slow-Set Filler

Although casein filler is not used much anymore, it is important to understand how it differs from the more common vinyl filler. There are those in the industry who don't realize the two types of fillers are different and expect vinyl filler to perform in the same way as did the casein. This misconception has caused quality problems.

The milk by-product, casein, is a binding agent. Casein, or blends of casein and soya proteins, were used at approximately 5 to 14 per cent by weight of total formulation. Because casein filler putrified, it was normally compounded only in dry mixes.

Casein filler produced perhaps the most positive form of bonding of all the fillers, but it had a major drawback. The mixed life of the filler was short. If casein filler was mixed and left in the pail for more than 24 hours, it rotted causing a horrible smell. As the casein decomposed, the filler lost its bonding properties and the effects showed up as cracking or peeling of the filler after it was dry. The mixed life of the filler was lengthened to some extent by the addition of mercury.

Casein filler was a good filler to use in humid situations. It would stay on the wall for a long time without drying, and as long as the temperature was gradually increased the casein filler would still bond.

Casein filler not only was more tolerant of moisture than vinyl fillers while drying, but also was less susceptible to the effects of moisture after it dried. In cases where the ceiling had been sprayed and the overspray scraped off the top angle, the angles filled with a casein topping filler were not likely to have the filler scraped off. Once dry casein filler would not soften in water very easily.

Vinyl Slow-Set Filler

The main part of slow-set vinyl filler is limestone or dolomite, the same basic ingredients of casein filler. The difference between the two is their bonding agents. Vinyl filler uses a vinyl compound (polyvinyl acetate) as a bonding agent. In much the same way that rubber glue forms a film at the surface when exposed to air, vinyl filler forms a film that extends throughout the drying filler creating physical bonds that give the filler internal strength. Powdered keetones and alcohols are added to vinyl filler and readily accept water. Thus vinyl filler mixes faster and smoother than casein filler. The adhesion of vinyl compound, while not as good as casein, is still more than adequate to produce quality work. As the filler dries, moisture is retained in the chemical compounds, but short fibres may be added to lengthen the drying time.

Vinyl filler dries best at the upper end of the temperature-humidity scale. Generally speaking the higher the temperature the better the drying process. The opposite was true for the casein fillers; they dried best at the lower end of the temperature-humidity scale. It is on this point where the difference between the two fillers has caused problems. Some finishers mistakenly think that vinyl filler has the same drying characteristics as the old casein filler.

There should be no cracking problems with vinyl filler unless there is an extremely heavy fill. Vinyl filler can be mixed with water of any temperature and a smooth material will result. Mixed vinyl filler will last longer than casein fillers but should be discarded after 48 hours because it may not adhere properly. Vinyl filler must dry within 72 hours of application, since the binder gradually decomposes and loses its bonding power when kept wet.

Vinyl filler comes in powder form in bags and also in a pre-mixed form.

Taping, Topping, and All-Purpose Fillers

Three types of vinyl filler are made in both powdered and pre-mix form: taping, topping, and all-purpose. They are produced from basically the same materials but by juggling the formula they exhibit different properties.

Taping filler should be hard and have good external and internal bonding. Smoothness is not of concern because the filler is not used as a finish coat. Taping filler is made by modifying the basic formula in one of two ways. The first one is to decrease the proportion of limestone therefore increasing the proportion of binder; the second is to leave the limestone the same but increase the amount of binder. In either case the proportion of limestone is decreased and therefore there is less demand on the binder to hold the material together. This makes a harder material owing to the greater amount of free binder for external bonding. Besides being harder than the basic formula, taping filler also shrinks more.

Topping filler must be soft, have little shrinkage, and produce a smooth, polished surface. A strong bond is not desirable because the topping filler is applied as a skim coat for finishing. To make a topping filler, the proportions of limestone and binder (to a lesser degree) are increased. The increased proportion of limestone makes the filler softer owing to the greater demand on the binder. Note that topping filler should not be used for taping because there is not enough free binder to give a good external bond.

All-purpose filler should be all the things that taping and topping filler are, but usually falls somewhere between the two. It does not have the same adhesive propoerties as taping filler, nor the smooth, polished surface of topping filler. The main advantage of all-purpose filler is that one type of filler can be used throughout the job. A disadvantage is that all-purpose filler is more susceptible to failures caused by job conditions than are the specialized fillers.

Pre-mix Fillers

Pre-mix vinyl filler has essentially the same composition as powdered filler. It is combined with water at the factory in a large mixer that produces a more uniform mix than can be made on the job.

Pre-mix filler is a relatively new product and as such has new problems. Powdered filler can be mixed, bagged, and sent from the factory to the job site with reasonable confidence that it will not change. Pre-mix filler is shipped as an emulsion and can undergo many changes between the factory and the job. Blocking (the solidifying or stiffening of the filler) occurs when the heavier materials settle to the bottom while the binder and other liquids float to the top. Sometimes the filler will lose its consistency and become as thin as water. Sometimes the color of the filler will change. Unless you understand the chemical composition of the filler, it is almost impossible to determine

why these things happen. Usually the problem can be traced to a minute change in the supplier's formula. The change may constitute only .01 per cent of the total formula but it can do all sorts of strange things. In most instances the filler can be re-mixed on the job and used, but it is best to contact the manufacturer's representative to determine what happened.

Pre-mix filler should never be made thicker by the addition of a powdered filler. The chemical reaction caused by mixing the two different fillers could produce a defective filler. Instead, use only pre-mix filler of the same type and manufacturer to thicken a pre-mix.

A primary complaint about pre-mix filler is that there is a lot of water in the box and this makes it too expensive. Actually, there is no more water than the amount needed to mix a powdered filler. The water must be paid for whether it is pre-mixed into the filler or someone's wages are paid to fetch it.

Another complaint is that pre-mix filler must be re-mixed before being used. This is true, but powdered filler must be re-mixed two and sometimes three times before a pail of it can be used. Once pre-mix is re-mixed it maintains its viscosity while powders generally do not.

Pre-mix is susceptible to temperature changes while stored, and care must be taken that it does not freeze. Stock should be rotated so that the filler is used within six months.

Fast-Set Filler

Fast-set filler is made with calcinated gypsum rather than the limestone or dolomite that slow-set filler is made of. Both fillers use a polyvinyl acetate binder. Calcinated gypsum means that the water that is chemically combined with the calcium sulphate has been driven off by the application of heat. When water is added to this compound, the gypsum chemically takes back the water and through crystal formation hardens or sets. Fast-set filler sets first then dries. Once set, the filler is structurally stable and can be coated. Fast-set filler is valuable to the finisher because it sets quickly and therefore can be coated quickly, and because deep fills can be made with it with little shrinkage or cracking.

Although fast-set filler will set in cold or humid conditions, it will not dry unless the same job conditions are present as are necessary for slow-set fillers. If the filler does not dry within 72 hours, the binder will decompose, decreasing the bond. If the filler dries too fast, the water will leave before the crystal growth is complete and shrinkage will occur.

The crystal growth of fast-set filler, once started, cannot be reversed or stopped. It is essential, therefore, that you mix only as much as you can use within the setting time of the material. The setting time usually ranges from 15 to 90 minutes, depending on the make of the filler, the age of the bag of filler, and the exposure the bag has had to moisture. An old bag of fast-set can be identified by a rotten egg smell when it is mixed. If the filler has been exposed to moisture the setting process will already have started and thus the setting time will be considerably shorter than is indicated on the bag. Using dirty water or mixing in a pail that has not been properly cleaned will also speed the setting process. Note that when fast-set is mixed in a pail, the pail must be cleaned out as soon as the filler starts to set or the filler will harden in place and the pail must then be discarded.

The setting process of fast-set can be speeded up or slowed down by the addition of additives. Aluminum sulphate (saltpeter) will hasten setting by introducing crystals for the gypsum to grow on. The addition of milk, on the other hand, will slow the setting process because the acidic gypsum will react with the protein in the milk before it starts crystal growth. Caution must be used when modifying fast-set, however, because the filler may fail owing to too much additive.

Fast-set is excellent for pre-filling, taping small jobs, and making deep fills. It is considered the drywall finisher's "little helper" because of its quick setting abilities. However,it is very hard to sand and therefore creates problems if not applied smoothly. Because of the crystal growth, the filler expands when it sets and can cause overfilling on joints and beads, especially when taping because it will leave the tape sitting above the surrounding surface of the board. When applying fast-set, finishers must take into account this tendency to expand.

Fast-set is acidic, while slow-set is basic. This is a problem because most paints are formulated to match the basic slow-set fillers not the acidic fast-set fillers. To overcome this problem fast-set must be covered with a coat of slow-set before paint is applied, otherwise the acidic gypsum in fast-set will discolor the paint.

Water Absorption and Drying

In order to understand problems that can arise with filler it is necessary to know something about how water is absorbed by filler and then given off during drying.

When a filler is mixed, the water mingles with the particles of filler and reactions start to happen. Limestone, because of its porous nature, begins to swell slightly as it absorbs water. This swelling is sometimes aided by a wetting agent. The binder is softened by the water and starts to reach out for the particles in the filler. The attapulgite clay and the mica trap water and retain it within the emulsion. The total amount of absorption is the water demand of the filler and occurs with the first mixing. A second mixing is then necessary to take the moistened particles and mix them so that the binder contacts the other particles. Without this second mixing the binder will not disperse throughout the filler.

When filler is first trowelled on the wall, the binder is dispersed evenly giving a good bond within the material itself. Then by working the filler with a trowel or a knife, the binder is placed in contact with the surface of the wallboard. The paper of the wallboard is a coarse kraft paper that has a rough surface with which the binder can intertwine.

Once filler is in place, the drying process begins. Generally, when water evaporates from a mixture shrinkage will occur, and when working with drywall filler shrinkage is the most important problem. Water evaporates from filler from three main sources. First, because filler is an emulsion, it has free water to be released. This water lies between the particles, and as it escapes leaves a space. Second, water escapes from the particles of limestone. Remember that as the filler was mixed the limestone absorbed water and swelled. Now, as the water evaporates, the limestone shrinks, leaving more space. Third, water evaporates from the binder. To make the binder soft and plastic, water was absorbed. Now that the filler is drying the binder shrinks. This is both good and bad. On the one hand binder shrinkage is undesirable, but on the other hand the ability of a binder to shrink is what actually creates the bond between the particles and the wall.

Fortunately, filler additives counteract some of the shrinkage. As the water escapes these additives form layers in the filler, bridging over some of the gaps being created by shrinkage. In so doing they diminish shrinkage and actually slow the drying as the water is trapped under the bridges and must take a round-about route to get out. This bridging process is important in preventing cracks in the filler that could result from rapid contraction of the binder.

Filler additives continue to work for the benefit of the material even after the filler has dried. They give the filler flexibility to withstand slight movement in the structure. The flexibility results because the additives that layer themselves throughout the material are much like the ironwork on a bridge; they are rigid but are able to withstand a certain amount of movement before they will collapse.

Filler Problems Related to Moisture and Drying

Water escapes to two places — into the air and into the wallboard. As the water escapes, a film starts to form at the surface of the filler. This is owing to the vinyl or plastic nature of the binder. This film, as already mentioned, is similar to the thin skin that forms over a drop of white glue as the glue first starts to set. The similarity is more than a coincidence because some pre-mix fillers use a binder that has many of the same characteristics as common white wood glue.

Once the film has started to form, the drying process slows considerably, leaving the water only one escape route — into the wallboard. The maximum moisture content for wallboard before filling is 15 per cent. When the moisture content is above this, the wallboard will not be able to absorb water from the filler. If the water cannot escape, the binder will start to decompose and the filler can fail. Such a failure will show up in the finish as cracking or peeling on the wall, or in what is called delayed shrinkage. Delayed shrinkage usually happens in buildings that have no heat at the time of taping and filling. When the heat is eventually turned on, moisture evaporates from the wallboard, allowing the water in the filler to go into the wallboard. As the water leaves the filler, shrinkage occurs. Delayed shrinkage can take place after the wall has been painted and as long as six months to a year after completion of the job.

Just as too high a moisture content in wallboard can cause filler problems, so can too low a moisture content. If wallboard is very dry because of extreme heating, the wallboard can suck the moisture from the filler too quickly making the filler difficult to work. Also the filler can fail to bond properly if the moisture leaves too fast to allow the binder to do its job.

Retention of water in filler will sometimes create a phenomenon known as photographing, a darkening of the filled joints, beads and nails after the surface has been painted or textured. The cause of photographing is as follows: because the filler is not dry, the paint, which also is usually water-based, cannot dry. A film does not form on the paint and therefore the paint overtop the filler has no finished surface. Light reflecting from this unfinished surface over the filler appears darker than the light reflecting from the finished surface over the rest of the wallboard. Note that the rest of the wallboard has a finished surface because there is no filler underneath it to prevent the paint from drying.

Fast-set filler reacts similar to slow-set under conditions of too much or too little moisture. If the wallboard is too moist, fast-set will harden even though the binder will not have a chance to dry. The filler will be hard, but it will not be bonded to the wall. If

the temperature is too hot, and the water escapes too quickly, crystal growth will not be complete and shrinkage, and possibly cracking, will occur. Thus under rapid-drying conditions, fast-set loses one of its main advantages.

Having pointed out these filler problems, it should be said that most of them can be avoided if filler is applied according to the manufacturer's recommendations. This is assuming that the manufacturer has formulated his filler so that it will remain stable under normal conditions.

Mixing Fillers

The mixing of all fillers should be done in clean pails with drinkable water. If an electric drill is used to mix filler, it should not exceed 450 rpm and preferably be 200 to 300 rpm. Mixing at speeds over 450 rpm will cause air to get into the filler and make it unsatisfactory for use as a coating material. As previously mentioned, the temperature of the water used for mixing powdered fillers is not critical.

It is important that the mixing tools, pails, and water be clean for several reasons:

1. Dry filler on the side of the pail will fall into the new batch and cause scratches in the filler when applied.
2. Filler of a different type may have been used before and the residue could cause chemical reactions in the new batch that would make it defective.
3. Dirty water from washing tools will have the same effect as residue on the inside of the pail.
4. Muddy water will cause scratches when the filler is applied.
5. Water that is not fit to drink may have enough chemicals in it to cause the filler to set, become rubbery, or undergo other undesirable changes.

Powdered filler is always added to the water. To start with, use half a pail of water and a bag and a half of filler. Mix the filler into the water until a stiff mud is formed. For best results, do not use the filler after the first mixing because its consistency will change as the compound absorbs water. It is best to let the filler stand for at least 15 minutes if the water is at room temperature, but longer if it is colder. The filler can then be mixed again and will be ready for use. A good system is to have enough pails so that the filler can be mixed and given the proper time to soak before it is re-mixed and used.

On a second mix most fillers will thin out. Therefore, don't add water until the mud has been mixed smooth and you can better see how much you need.

Remember: the most dangerous time that powdered filler is handled is when it is being mixed. Wear a mask to protect your lungs from the filler dust.

There are two ways to break down a filler emulsion. One is to let filler stand for more than 48 hours in a pail. The other is to mix filler too long. The longer the filler is mixed, the further the heavier particles are separated from the lighter. This is especially true with fast-set filler. If mixed too long the crystals will not form and the filler will not set. As a rule, if it takes longer than five minutes to mix a pail of filler to working consistancy, there could be a problem with the formulation of the filler.

As stated earlier, a filler can have as many as 20 differnt additives. However, the additives in one filler are not necessarily the same as those in another filler. Therefore it

is not advisable to mix fillers from different manufacturers in either powdered or pre-mix form. Also make sure that all tools are clean when changing from one brand of filler to another, since even a small amount of filler can cause a reaction that could create a rubbery filler that is impossible to work with. Moreover, some fillers of the same brand name will not intermix.

Definitions Related to Filling Compounds

Drying	Evaporation of free water from an emulsion to provide a hard, stable material.
Emulsion	Mixture of materials suspended in a medium such as water. The materials are not chemically bonded.
Filling Compound	An emulsion of water, filler, binder, binding modifiers, and additives.
Filler	The term filler is generally used as a short form of filling compound. More specifically, filler is the material (limestone, dolomite, or gypsum) that makes up the major portion of a filling compound.
Float	Movement of a blade over a plastic material such as plaster to make a smooth surface on the material.
Free Water	Water in a substance that does not chemically react with the substance.
Plastic	Soft, smooth emulsion.
Setting	Crystal growth by means of a chemical interaction of materials in an emulsion. When setting is complete, a hard stable material is produced from which free water is lost.
Thixotropic	The property of filling compounds of changing from a semi-solid to a liquid at the point of being sheared or cut with a blade and then returning to a semi-solid immediately after the blade has passed through.

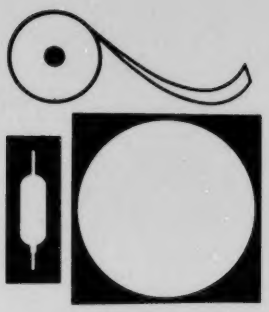
SUMMARY

- Filler formulated for one location may not be suitable for another location with a different set of climatic conditions.
- A drywall filling compound consists of filler, binder, binder modifiers, and additives.
- The name vinyl filler comes from the polyvinyl acetate used as a binder in the filler.
- Slow-set filling compounds contain limestone or dolomite as a filler, whereas fast-set filling compounds contain calcinated gypsum as a filler.
- Vinyl fillers must be used within 48 hours of mixing. They must dry within 72 hours of application. Vinyl fillers can be used at high temperatures.
- Slow-set, vinyl fillers, in both powdered and pre-mix form, are formulated for taping, topping or all-purpose use. Taping filler is harder and shrinks more than topping filler. Topping filler is soft and easily sanded. All-purpose filler is halfway between the two.

- Fast-setting filler hardens first through crystal formation and then dries. The binder is polyvinyl acetate. Fast-set expands as it dries. It is used for pre-filling, taping small jobs, and making deep fills. Fast-set is hard to sand, and must be skim-coated with slow-set filler before painting.
- Pre-mix filler has a similar composition to powdered filler but is factory mixed. It must be re-mixed before use. Care must be taken to ensure that it does not freeze. It should be used within six months.
- Filler additives slow the drying process and counteract shrinkage.
- Once the film has formed on drying filler, the remaining water in the filler must escape through the wallboard.
- Photographing is caused by paint being applied before filler is dry.
- Mixing of fillers should be done in clean pails using drinkable water. Electric drills are best run at 200 to 300 rpm and should never exceed 450 rpm.
- Powdered filler should be mixed twice before using. A pail of filler that is well mixed will be free from lumps and be of the same consistency from top to bottom.
- Always wear a mask when mixing powdered filler.
- Fillers from different manufacturers should not be mixed because they could be incompatible. Even fillers from the same manufacturer can be incompatible.
- Fillers should not be mixed too long, usually, no more than five minutes.

EXERCISE

1. Why should trowels and knives for drywall finishing be filed square?
2. True or False? Fillers are the same all across the country.
3. What are the four parts of unmixed filling compounds?
4. In a filling compound what is the function of the binder? The additives?
5. What is the difference between a taping and a topping filler?
6. What are the two main advantages of fast-set filler?
7. What are the three common uses of fast-set filler?
8. Shrinkage occurs when water escapes from drying filler. What are the three sources of escape for water from the filler?
9. Why should different types of filler not be mixed?
10. What is the recommended speed range for a drill mixing filler? What speed should the drill not go beyond?
11. What is the additive mica used for in filler?
12. True or False? When mixing, water is always added to filler.
13. Filler should not be left in a pail longer than ———— hours.
14. If filler that has a film formed on it is trowelled what happens?



Safety

MODULE 2

INTRODUCTION

This module is a guide to safe working habits for drywall finishers. The frequent lack of proper safety procedures is a major concern in all trades. Workers are too often players in risky games in which they have so much to lose and so little to gain. Playing a game with your livelihood may be as simple as using an improperly prepared scaffold. If you win, maybe you save a little time. If you lose, you could be off work with an injury and lose money. Or if the accident is more serious you could permanently lose your health or even lose your life.

Perhaps the biggest contributor to unsafe work habits is the attitude that if something isn't directly related to production, you haven't got time to do it. This attitude causes workers to take chances that often result in injuries. Take the extra minute to play it safe; you'll save time in the long run.

The Workers' Compensation Board provides benefits, including medical costs, for injuries sustained on the job. They inspect job sites for unsafe equipment and work methods. They provide rehabilitation services to help the injured return to work, services that are given whether or not the worker was at fault for the accident. They publish an information booklet on their services, and it is in your interest to obtain one and read it.

The Workers' Compensation Board also publishes a book of regulations that apply to all places where people work. You are expected to know the regulations that apply to the drywall industry. However, WCB does not cover all the safety problems specifically related to drywall finishing, and therefore these concerns are dealt with here.

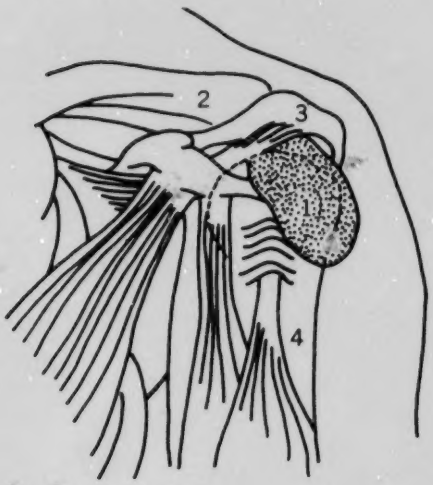
Injuries Common to Drywall Finishers

In drywall finishing certain parts of the body are susceptible to injury. The back and the arms are first to let you know there is something wrong with the way you are working. The arms are constantly being used and abused leaving the shoulder and elbow vulnerable to bursitis (Figure 2-1) and the wrist to tendonitus.

Tendonitus is basically the seizing of the tendons in their protective sheath. Like a brake cable on a bicycle, the tendon is surrounded by a sheath that is filled with an oily substance for lubrication. Overuse of the tendon causes a breakdown or loss of the oil, which then causes friction and inflammation of the tendon and the sheath. This can be very painful for a short time, but will eventually repair itself when the body replaces the oil in the sheath. Tendonitus in the wrist and forearm is a common ailment for

people new to the trade who have been coating nails all day.

Bursitis is a more serious injury because it affects the joints of the arm. The bursa is a fluid-filled sac that creates a cushion or pad for the ligament to run over. With constant use, the ligament may put enough pressure on the bursa so that the inner surfaces contact each other and start a fibrous growth within the bursa. This causes inflammation as the bursa loses its cushioning effect. Under extreme conditions, the body will send other fluids into the bursa resulting in calcium deposits that must be surgically removed. In most cases, heat and anti-inflammatory drugs will cure bursitis. More serious cases will require injections of cortisone (a lubricant), or hospitalization. The injections are a temporary solution, however, as the bursa will again lose its fluid and collapse.



(1) A distended subacromial bursa. Slight movement of the other structures, (2) collarbone, (3) acromion, and (4) humerus, pinch the inflamed bursa and cause excruciating pain.

Figure 2-1
Bursitis in the Shoulder

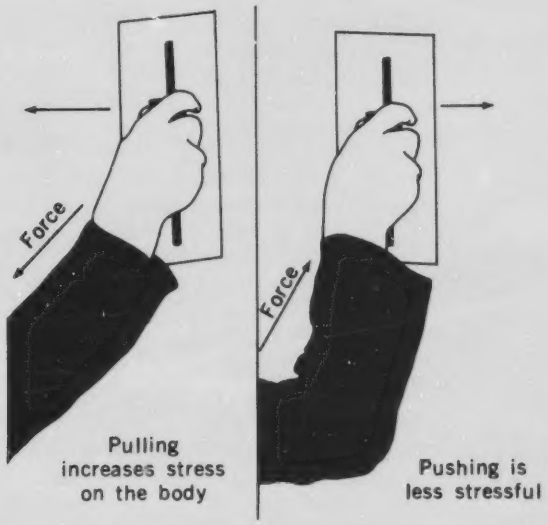
Drywall finishers are also susceptible to back problems. Back problems are caused by overreaching or applying pressure to the back when it is in awkward positions such as can occur while operating a taping machine. The weight of an automatic taper or flat finisher, plus the leverage that the handle creates, multiplies the stress on the back's discs and ligaments. This can cause the discs to rupture and release fluid into the spinal column, creating pain in the lower back and legs. An injured disc will never heal to its pre-injury state because scar tissue forms that reduces the flexibility of the disc. Afterwards, when pressure is put on the disc, it will burst more easily. Back injuries are lifetime injuries.

The intention here is not to paint a bleak picture of injuries, but rather to make you aware that injuries are an occupational hazard and that you should give thought to your working techniques. By developing careful work habits you can prolong your working life as a drywall finisher.

Minimum Stress Trowelling Techniques

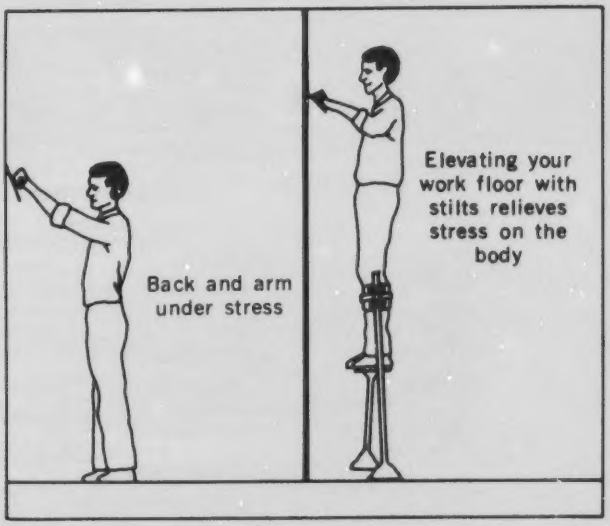
Pulling a trowel causes stretching of the muscles and joints which sooner or later will cause your elbow and shoulder to hurt. Pushing a trowel, on the other hand, puts less stress on arm muscles and joints. Therefore, use a pushing motion whenever possible while trowelling (Figure 2-2).

Figure 2-2



Also keep your arm close to your body to reduce strain. The further your arm is from your body the more stress is put on it.

Figure 2-3



If you trowel above shoulder height, the tendency is to arch your back to put more pressure on the trowel. This puts more pressure not only on your arm, but also on your back (Figure 2-3). To avoid this stress elevate your position with stilts or scaffolds so that you do not have to arch your back.

When trowelling near the floor, bend your knees instead of your back. The same principles that apply to lifting also apply to trowelling.

Minimum Stress Techniques with Taping Machines

While taping machines considerably speed the taping process, they can shorten the working life of drywall finishers. Muscles and joints are attuned to the length of the limbs. When a taping machine is used, it extends the length of the arms and in so doing puts stress on the arm muscles and joints and on the back. Taping machines must be held correctly with the body in the right position to minimize the stress.

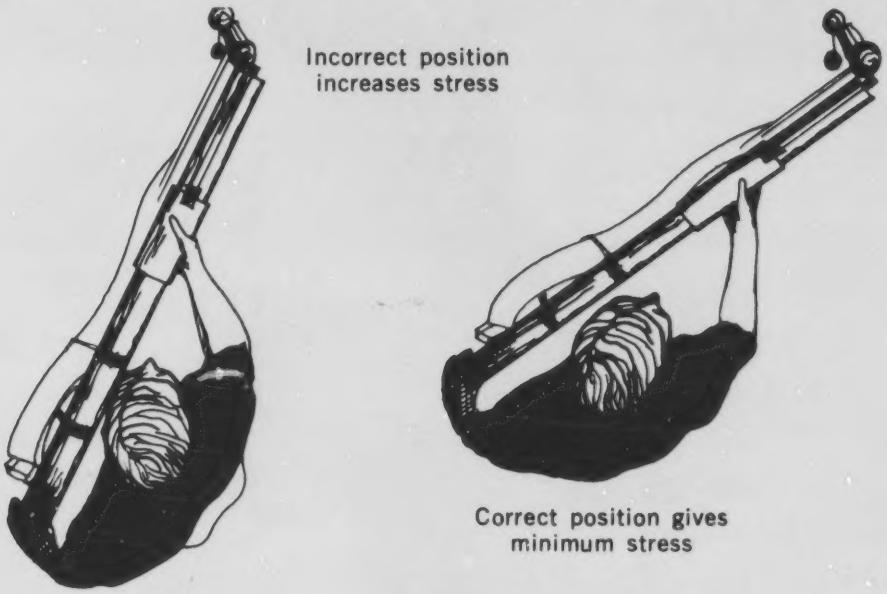


Figure 2-4

As discussed earlier drywall finishers are susceptible to elbow, shoulder, and back problems. Although WCB does not consider the machines themselves a cause of these injuries, a good case can be made showing that improper techniques when using taping machines cause injuries that reduce working life.

One of the problems with machines is their speed. There is a tendency for the operator to maintain the speed even in situations where the use of a machine is not feasible, for example, where it is necessary to stretch or bend the back. While an automatic taper may weigh only 15 kg when full, the force it exerts is multiplied the further it is used from the body. Know the limitations of your body: do not exert needless, and ultimately damaging, strain on yourself.

Don't walk backwards with the automatic taper, as is common practise, twisting your body to see where you are walking. This puts strain on your back muscles, ligaments, and discs. A much better method is to turn your hips so that you walk forward with the taper, pusing it at an angle parallel to the line formed by your hips and shoulders (Figure 2-4). Pushing a taping machine is easier on your body than pulling it.

When working above your head, try to keep your arms straight so that the force is transferred through your skeletal structure to the floor. If you bend your limbs, the force is transferred to the joints, which were not meant to withstand such pressure. When using a machine on horizontal joints, bend one arm and brace it against your body to put pressure on the machine. By doing this, no injurious pressure is transferred to your arm joints. Remember, continuous pressure on joints hastens wear on the joints. Don't use working techniques that cause your body to wear out before its time.

Safe Practice with Stilts and Scaffolds

Any time you work on stilts or scaffolds there is a potential for injury. Therefore use extra caution, and accept the fact that production is necessarily slower when working on them. Also adhere to the following safe practices.

Preparing Stilts

1. All straps must be secure and strong.
2. The top of the leg support should fit just below the knee.
3. The tube of the leg support should pass directly over the ankle bone.
4. Foot plates should allow the shoe to fit snugly into the slit.
5. On adjustable spring stilts, the spring should be adjusted so that walking feels natural.
6. All rubber pads must be secured to the stilts, and they must be clean and in good condition.
7. All nuts and bolts must be tight.
8. All worn parts should be replaced.

Putting on Stilts

1. Beginners may need to lean against a wall for support.
2. Fasten the top straps first.
3. Fasten the foot straps.

Note: This sequence will minimize the likelihood of a broken ankle should you fall before the stilts are completely fastened.

Working on Stilts

1. Make sure all floors are clean.
2. Make sure all fixtures protruding from the floor are clearly marked.
3. All safety railings must be elevated to prevent you from falling over them.
4. Note all protrusions from ceilings.
5. Note all ceilings that are lower than average.

6. Insulate all live wires hanging from ceilings.
7. Stilts should be of a comfortable working height.
8. Do not wear stilts on stairs, planks, or elevated work surfaces.
9. The suggested maximum safe height for stilts is 60 cm.

Preparing Scaffolds

1. The minimum dimension of the plank is 38 mm x 235 mm (nominal size).
2. All planks should be of strong knot-free wood.
3. Ensure a minimum of two planks per work floor.
4. The maximum height of a free-standing scaffold is 3 times minimum base dimension.
5. The maximum height for remaining on a moving scaffold is 2 times minimum base dimension.
6. The maximum height for remaining on a scaffold while moving it yourself is 1.5 times minimum base dimension.
7. All cross braces and safety railings must be in place.
8. All parts of the scaffold should be erected so there is no danger to other workers.
9. The wheels should be a minimum of 12.7 cm diameter.

Working on Scaffolds

1. If no guard rail is feasible and you are more than 3 m from the ground, a safety rope should be worn.
2. Tools and materials should be lifted to the work surface with a rope.
3. Ladders, stilts, sawhorses, or other means of elevating yourself must not be used on a scaffold.
4. While on a scaffold that is being moved, keep a low profile.
5. A scaffold should not be moved until everyone concerned is aware that it is about to be moved.
6. Let your co-worker on the scaffold know what you are about to do.

Constructing Safety Railings

1. The minimum height of a safety rail is 1 m.
2. Safety rails must be sturdy enough to restrain a fall.
3. Elevator shafts, stairwells, and holes in floors or exterior walls should have safety rails or be closed.
4. Scaffolds and walk ways should conform to WCB regulations regarding safety rails.

Working with Ladders

1. The feet of the ladder should be the non-skid type.
2. The feet of the ladder should be placed one metre away from the wall for every 4 vertical metres (Figure 2-5).

3. When a ladder leads to a landing, it should go in beyond the landing.
4. Wooden ladders should not be painted.
5. Always face a ladder when climbing up or down it.
6. Watch for electrical hazards when carrying and placing a ladder.

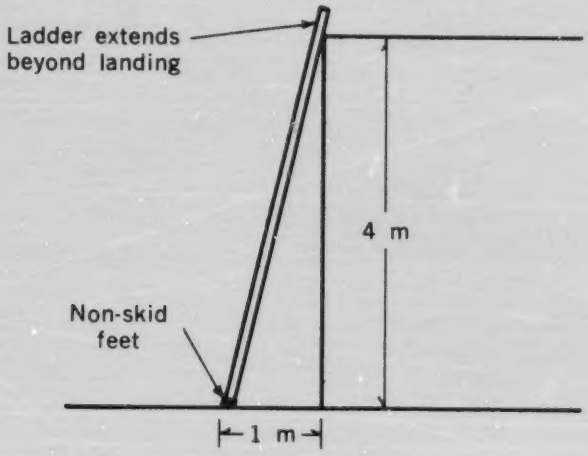


Figure 2-5
Ladder Safety

Safety Precautions with Floors

Drywall finishers spend their time on walls and ceilings, not on floors. There are, however, some minimal precautions that should be taken with floors:

1. Protruding pipes should be shielded or made more visible.
2. Holes such as heating vents should be covered when practical with material that will support your weight.
3. Scrap such as pieces of wire or pipe, paper, wallboard, plastic, cardboard should be pushed aside where it is least likely to get in your way.
4. Other trades' materials, if they are present, should be neatly piled so that they can't be tripped over.
5. Filler or water spills should be removed immediately.
6. Pails and equipment should be kept out of the work path.

Electrical Equipment Precautions

All electrical equipment must have a grounding system — a plastic double-insulated handle or a grounded plug. As a drywall finisher, you will be working primarily with 110 V conducted through a cord of three wires — a black, a white and a green. The black and the white wires carry the electricity and the green one is the ground. At the male end, the ground is connected to a metal rod sunk into the ground outside the building, and any power running through this wire is dissipated into the earth. At the female end,

the green wire is connected to the ground wire running from the tool casing. A short in the wire will energize the casing of the tool. With the ground wire hooked up, the power passes harmlessly through the green wire. If the ground wire is not hooked up, the electricity will take the only other route available — through the person holding the tool. If you are wearing good footwear that is dry and has no holes, you will feel only a tingle; if you are wearing poor footwear, you will feel a good "shot." The nervous system is an electrical system and conducts electricity very well. A mild electrical shock can cause temporary paralysis of a muscle. A more serious shock can cause unconsciousness, in which case the victim should be rushed to a hospital.

Because the finisher works with electric drills and water when mixing filler, there is a danger of electrical shock. As a precaution, make sure that the drill is properly grounded or has a plastic double-insulated handle. Keep the floor around the mixing area dry, and do not leave the drill in the mix in a position that it can be knocked over. If you come across a drill lying in a pool of water, unplug the drill before you pick it up. Stay out of the pool of water because it may be energized.

Triggers on drills have a tendency to stick in the "on" position. This can be dangerous especially if you are mixing a thick mix. The pail may begin to spin or the drill may spin out of your hands and injure your wrists or legs. Make sure the trigger easily returns to the "off" position. If not, have the drill repaired.

Some job sites have 220 V hook-ups for certain carpenter's tools. Some people try to run 220 V through a 110 V cord by eliminating the ground. If you hook up a 110 V tool to a 220 V power source, you are energizing the casing of the tool. Since there is no ground, if a short occurs, you will be on the receiving end of a 220 V jolt. To be safe, use only the cords supplied by your employer or yourself.

On most large job sites, a laser level is used. A laser beam is a high energy beam of light. The level is perfectly safe as long as you do not look directly into the beam. However, prolonged viewing directly at a laser beam can cause damage to the retina.

Pressurized Equipment Precautions

A drywall finisher works with both air pressure and hydraulic pressure. Two major safety concerns with pressure are:

1. The point where the pressure is released should be properly shielded and safely controlled.
2. The hoses carrying the pressure should be in good shape and have sound connections.

Never point a pressurized hose at yourself or anyone else. Follow the safety recommendations in the manufacturer's operator's manual, and do not operate the equipment unless you have proper training.

Dust Protection

The body has a natural protective system to screen out dust. The lungs are lined with tiny hair-like cells called cilia, and a sticky substance called mucus. The mucus acts like flypaper as it catches dust particles that enter the lungs. The cilia are constantly in motion, and pass the particles out of the lungs. However, very fine fibres such as asbestos fibres are able to bypass this protective system and penetrate the part of the lungs where the oxygen enters the blood. The lung tissue here is very soft and easily

punctured by the sharp needle-like asbestos fibres. Continued breathing of asbestos fibres can cause asbestosis, a serious disease of the lungs. It can also cause lung cancer.

In the past drywall filler contained asbestos, but now fillers, by law, must be asbestos-free. The material substituted for asbestos is attapulgite clay (Minigel and Attagell are two trade names for attapulgite clay). To date no hazard has been reported with attapulgite clay. However, it took medical science 25 years to discover that asbestos was harmful, so it's better to be safe and wear a mask.

Masks should be worn in the following situations: mixing powdered fillers; sanding all fillers; cleaning floors; spraying ceilings, The worst of these is mixing powdered fillers. Thus pre-mixed fillers have an advantage since they require no dry mixing.

The type of mask you use is very important. It must be approved for pneumoconiosis-producing dusts. This approval will be found on the box, not on the mask, and will consist of the letters NIOSH, MESA, or U.S. Bureau of Mines, and a series of approval numbers. Contact a safety supply company and ask them to show you some approved masks. Approved disposable masks are also available. All masks must have two straps to ensure a tight fit to your skin. To be most effective, there should be no facial hair in the area that the mask will contact.

Another dust protective practice is to change your work cloths before leaving the job. This way you won't be carrying the dust home with you every night.

If you develop a skin rash on your shoulders and down your back and arms, see your doctor and let him know that you work with filling compounds. Also, it is a good idea to have regular medical checkups and chest X-rays. This will enable your doctor to know when there is a change in the health of your lungs. If you develop a lung disease, these X-rays could help to prove to the Workers' Compensation Board that the disease is job-related and therefore is subject to compensation.

Eye Protection

To protect your eyes, invest in a reliable pair of safety glasses. They are especially helpful when texturing ceilings. They get dirty and you may have to stop to clean them, but when you do you can see how much material you have prevented from getting into your eyes.

Noxious Fume Protection

Noxious fumes are present when using some of the special sealers for sealing off water or smoke stains. The fumes from solvents enter the bloodstream and cause dizziness. Any material that causes dizziness is affecting your brain cells. Filters that filter out the toxic fumes can be bought to fit the type of rubber masks that have screw-on canisters. In addition, it is wise to have the best ventilation possible when working with toxic fumes, even when wearing a mask.

Ventilation is also important when using gasoline engines to power equipment or when using combustible fuels for heating. Without venting, the amount of carbon monoxide in the air can build up and cause nausea, drowiness, and under extreme conditions, unconsciousness or death. The heater or engine should be vented to the outside; an elevator shaft should not be used because it will disperse the carbon monoxide throughout the building.

Hearing Protection

Very little attention has been given to the noise level on some drywall finishing jobs. The texture machines are especially noisy. The noise from the gasoline engine, the pump, and texture wand, when combined with the noise of the drills used for mixing, may cause a hearing loss. Always wear ear protection when mixing the material or operating the wand.

Head Protection

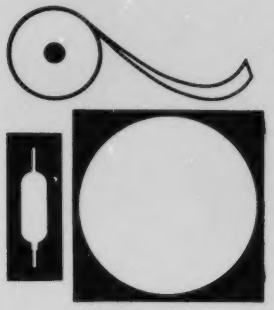
While it is not common for drywall finishers to wear a hard hat when working, WCB regulations require one to be worn whenever there is a danger of falling material. This means that a hard hat is required when working below a scaffold, and when entering or leaving some job sites.

SUMMARY

- Know all the Workers' Compensation Board regulations that apply to drywall finishing.
- Make sure the floors are safe to work on.
- Make sure all stairwells have railings, and that safety rails are in place around elevator shafts and holes in the floor.
- Check your stilts regularly and replace worn parts.
- Make sure your scaffold conforms to Workers' Compensation Board regulations.
- To minimize stress on your body and the possibility of getting tendonitis, bursitis, or back trouble, use good working techniques.
- Always wear a mask when dust is present.
- Vent to the outside all gasoline engines. Provide adequate ventilation for kerosene heaters.
- Always wear safety glasses when texturing.
- Always wear ear protection when working with large texture machines.
- Observe safety precaution with pressurized equipment and electrical equipment.

EXERCISE

1. What is the acceptable diameter of wheels used for scaffolds?
2. What are the height restrictions for scaffolds?
3. Is your present mask approved for pneumoconiosis-producing dusts?
4. What is the role of the Workers' Compensation Board?
5. What are three strain-related injuries common to drywall finishers?
6. What are two potential hazards with electrical mixers for fillers?
7. When would you be required to wear a hard hat?
8. What is the main cause of injury when working with taping and filling machines?
9. What are four techniques for minimizing stress when trowelling?



Applying Bead

MODULE 3

INTRODUCTION

There are many types of beads and several methods of attaching them. Basically, they all serve the same purpose — finishing and protecting the corners of wallboard. They provide a smooth, straight, unbroken edge that is then filled to blend into the wall making a uniform surface. Beads fall into two categories: corner beads and edge trims. Each has a specific use; they are not interchangeable.

All beads have two parts: the finishing edge, or nose, and the flange (Figure 3-1). The finishing edge is the part that shows after the bead has been filled and sanded. It is smooth and rounded to provide a smooth finished surface that filler does not stick to. The flange is the part that attaches to the wall and holds the filler on the bead. It is knurled to provide a keyed surface for filler and has holes punched in it at intervals for attaching it to the wallboard.

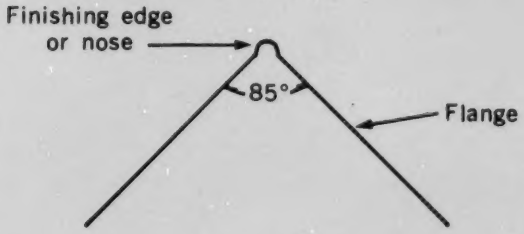


Figure 3-1
Bead

This module describes the types of beads and trims, their advantages and disadvantages, where they should be used, and how they are cut and applied.

Beads

The five corner beads most often used in the industry today are: metal corner bead, veneer bead, paper corner bead, screen bead and flexible or roll-on bead. Paper, screen, and flexible corner bead are called glue-on bead because they are attached with filler. Metal corner bead and veneer bead are attached with fasteners.

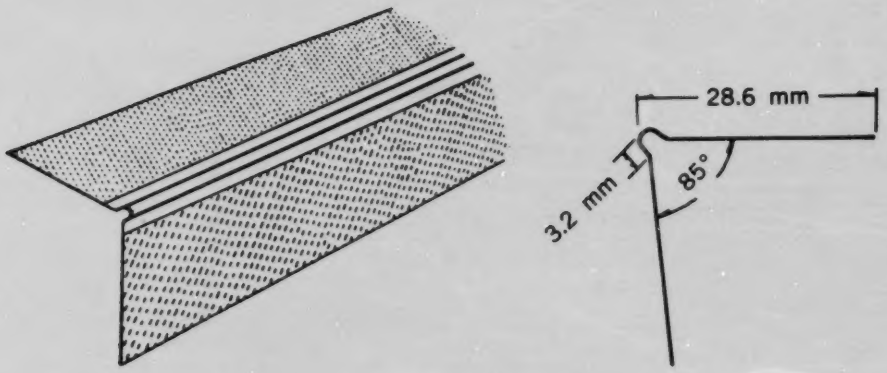


Figure 3-2
Metal Bead

Metal Corner Bead

Metal corner bead (Figure 3-2) is made from electro-galvanized metal to prevent rusting under normal use and filling conditions. Fasteners are applied to the flange of the bead to hold it in place. Metal bead can be nailed, screwed, or clinched. Nailing and screwing attach the bead to the framing members so that it will not pull loose. Clinching attaches the bead to the surface of the wallboard. Teeth of a tool called a clincher cut the flange of the bead and force the tangs of metal into the core of the board.

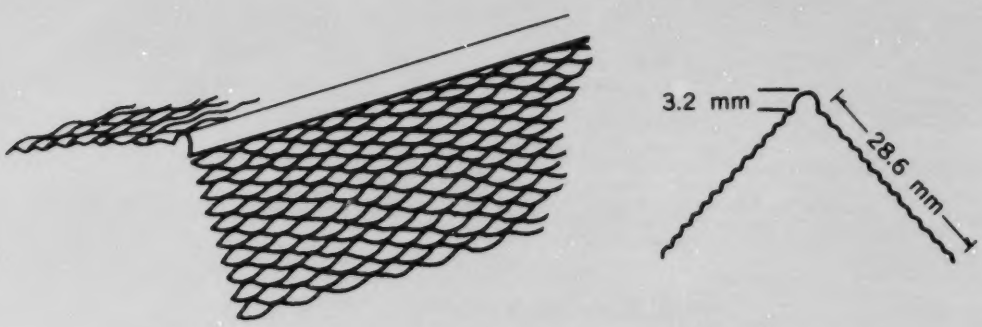


Figure 3-3
Veneer Bead

Mini or Veneer Bead

Mini bead, also known as veneer bead (Figure 3-3), is the best bead to use when a corner must be plumbed or straightened. The metal mesh can be fastened at any point along the flange without twisting the bead. Veneer bead is usually stapled to the wallboard.

Stapling does not provide a solid attachment since the bead is independent of the framing members. The addition of the filler provides a more positive bond because the filler flows through the mesh and adheres to the surface of the wallboard, creating a sandwich effect. This type of bead perhaps is the strongest and best wearing of the metal corner beads.

One disadvantage common to all metal corner beads is that a positive bond to the surface is not formed along the entire length of the bead. Therefore the bead could be loose in spots, causing the flange to lift from the wall surface and create cracks if the bead is bumped after it is filled. Another disadvantage is that the smooth, round edge of the bead does not provide a well-keyed surface for the adhesion of paint, causing the paint to chip off on contact. Despite these drawbacks, metal beads are the most commonly used because of speed of application.

Glue-on Paper Bead and Screen Bead

Glue-on paper bead (Figure 3-4) forms the most positive bond to the wallboard. It is glued to the wallboard with taping filler. The paper of the bead is the same as that used for joint tape. The cross-fibres of the tape provide strength in all directions and enable the filler to penetrate the tape and form a strong bond. Paper bead has a partial metal lining for rigidity.

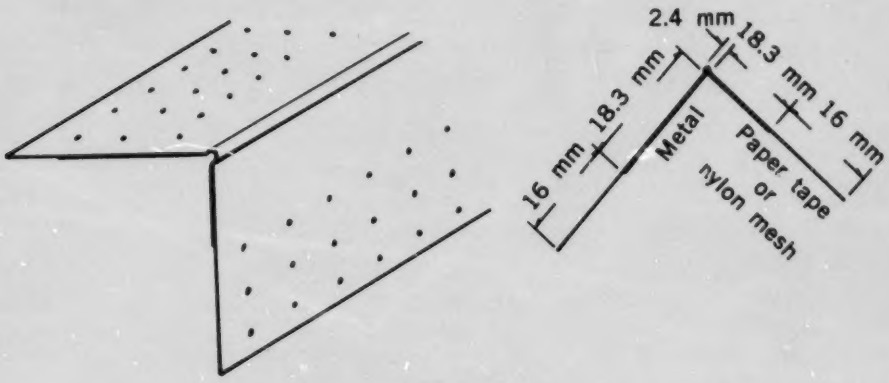


Figure 3-4
Paper Bead

Screen bead (Figure 3-5) is also glued on. The screen allows filler to flow through and create a strong bond. Screen bead has a metal finishing edge like metal corner bead.

Because taping filler is used to adhere glue-on bead, the gap is filled between the metal of the bead and the wallboard providing a solid backing for the finished edge. Being more solid, glue-on bead withstands much more abuse than the metal bead, which has a hollow space behind the finished edge. The paper bead has especially good paint adhesion and will withstand bumps and knocks without chipping. Glue-on bead can be applied to any wallboard surface whether there is backing or not. It is not affected by the movement of the framing members and is bonded along the entire length. Because

of the height of the finishing edge, glue-on bead requires less filler to achieve a finished surface.

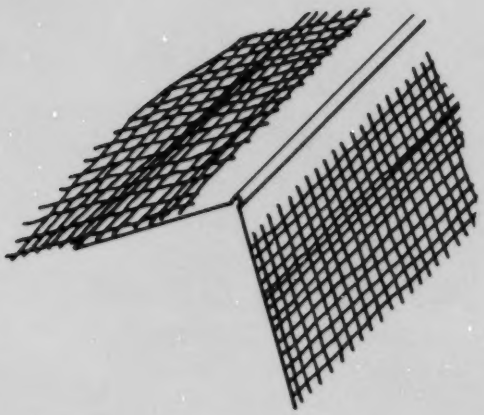


Figure 3-5
Screen Bead

However, there are disadvantages to glue-on bead. It requires more skill in application because of the low profile of the finishing edge. Unlike with metal corner bead, you cannot fill glue-on bead immediately after applying it because you have to wait for the filler to dry. Also, the application is slower and messier than that of metal corner bead. Another disadvantage is that the finishing edge of paper bead is easily damaged during application if a blade is run over the edge too many times. This causes the paper to fray or become fuzzy, detracting from the finish.

Glue-on Flexible Bead

Flexible bead (Figure 3-6) is excellent for internal and external angles that are greater than 90°. It is similar to paper bead, except that it comes flat in rolls and its metal lining is softer to permit bending of the bead to match the angle. Flexible bead will not withstand bending more than twice; any more and it will crack down the centre and be useless.

On external angles, flexible bead is applied with the paper side out, whereas on internal angles the metal side is out. While it is possible to use paper tape on internal angles greater than 90°, flexible bead provides one main advantage for these angles: the groove in the bead provides a very accurate guide for filling so that it is much easier to make a straight line. Flexible bead, because of its flexibility, requires more skill to apply than other bead.

Edge Trims

A finishing trim is used to cover the rough edge of wallboard to provide a smooth finished surface for paint. Edge trims are usually metal or plastic. Also, some glue-on trims are available. There are two basic shapes of edge-trim — L-bead and J-bead — the names denoting their shapes.

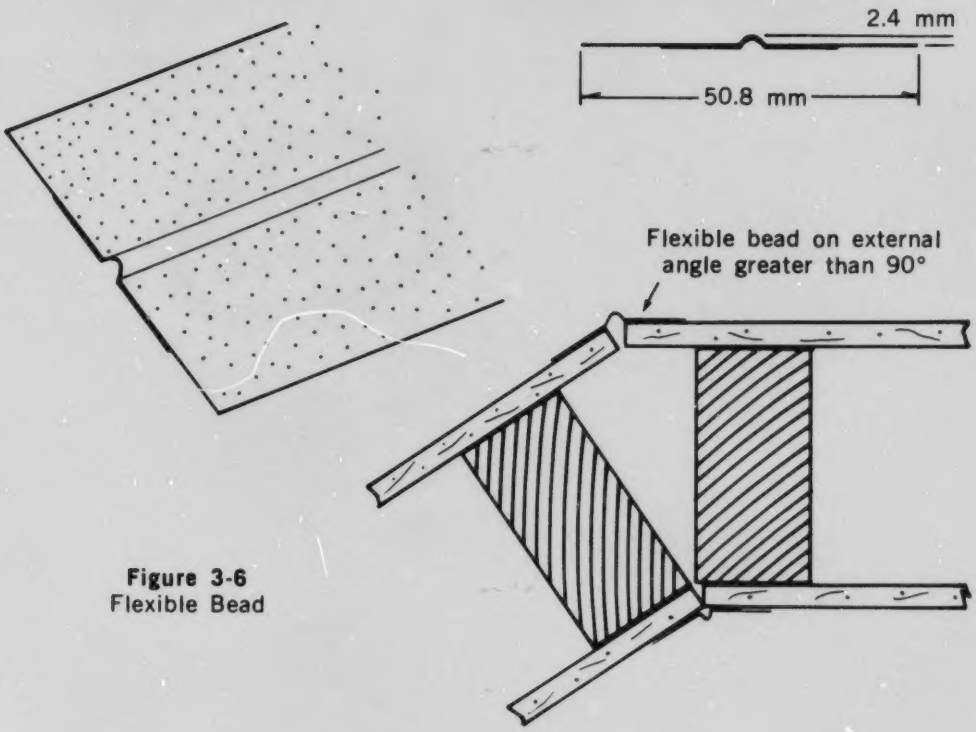


Figure 3-6
Flexible Bead

L-bead

L-bead (Figure 3-7) is used to finish the rough edge of wallboard where it abuts a wood, plaster, or concrete-block wall or a T-bar ceiling. It is normally screwed or stapled in place. L-bead is especially valuable for finishing long edges. Because it is put on after the wallboard is in place, L-bead can be staggered so joints in the bead do not coincide with joints in the wallboard. In addition, L-bead can be easily adjusted to form a straight, level edge.

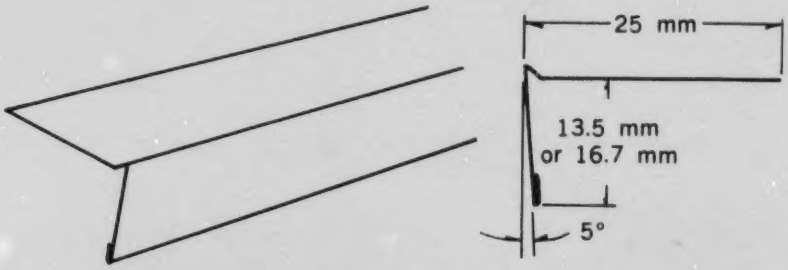


Figure 3-7
L-bead

J-bead

J-bead (Figure 3-8) is used when there is no backing to nail or screw to — for example, around a valance or a closet opening that has an overlap. It is held in place by compression, since the channel of the bead tapers slightly to provide a tight fit.

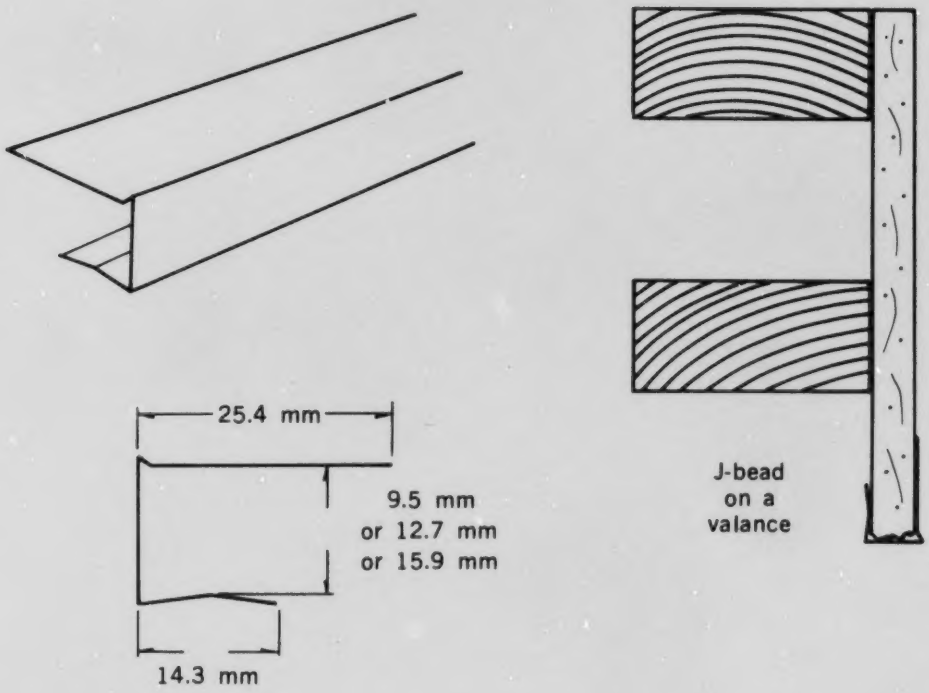


Figure 3-8
J-bead

J-bead is not easily controlled, however, because once it is on the board it fits tight and does not come off without bending. It may be used on a full-length sheet, but in areas where more than one sheet are used it is not desirable since the joint in it would fall at the butt joint and cracking would occur.

Square-Nose Bead

Another type of J-bead is square-nose bead (Figure 3-9). Square-nose bead is similar to J-bead in shape and use but does not require filling. The finished edge is exposed and requires only painting to complete it.

Figure 3-9
Metal Square-Nose Bead

Plastic J-bead

Plastic J-bead (Figure 3-10) is similar in shape to square-nose bead and like square-nose bead it is a finished trim that requires no filling. It is used around windows that have a wallboard liner. The plastic J-bead is put on the edge of the board that contacts the window frame and acts as a vapor barrier between the window and the exposed core of the wallboard. It is very flexible material and care must be taken to make sure it is not bent during application.

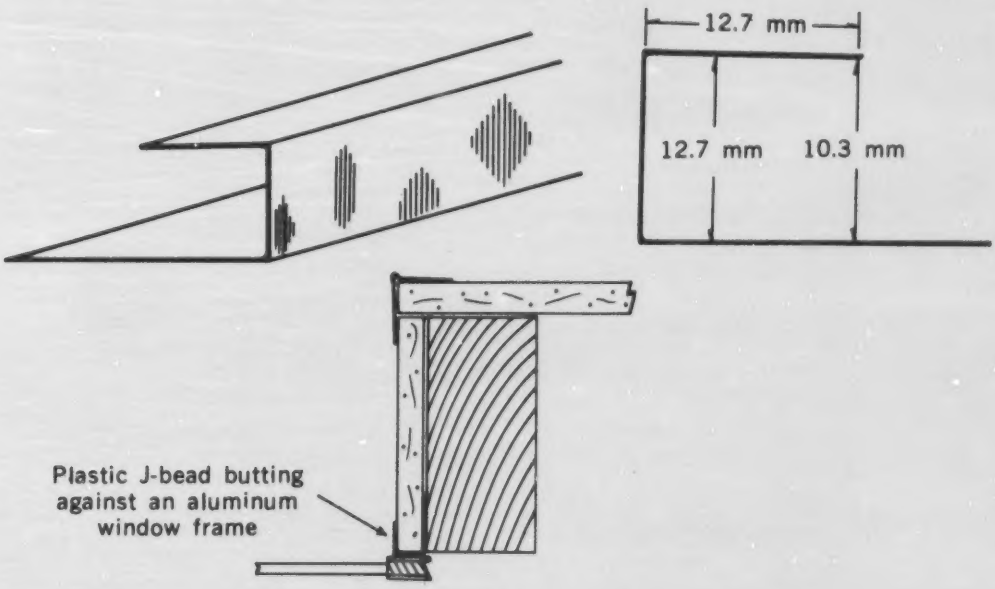


Figure 3-10
Plastic J-bead

Other Beads and Trims

Expansion Bead

On walls where wallboard is joined on a wide-wood framing member, an expansion joint is left to allow for movement from settlement of the building or shrinkage of the wood. In some cases a smooth finish will be specified and it is necessary to use an expansion bead (Figure 3-11). The expansion bead is fastened with nails or screws so that the bead is centred in the expansion joint. It is then filled and the vinyl strip pulled out to leave a clean gap that will open or close with the movement of the wall.

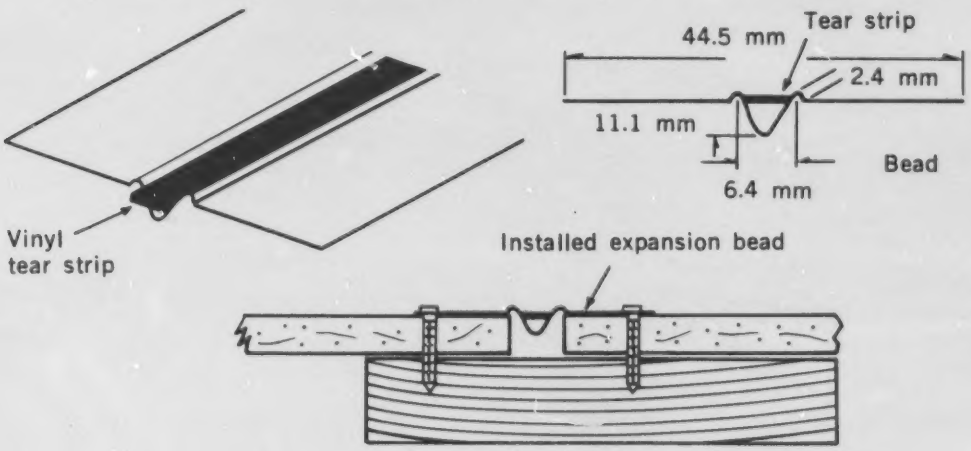


Figure 3-11
Expansion Bead

Speciality Beads and Trims

The beads and edge trims covered in this section are the most common in the trade. There are speciality beads for joining uneven surfaces of plaster and drywall, but they see limited use. There are also various type of flanges for edge trims. These flanges are similar to those discussed for beads.

Measuring and Cutting Beads and Trims

Tools

The tools required for measuring and cutting beads and trims are available in any hardware store. Aviation snips are recommended because they are pointed and the blades are tight-fitting with a compound action. These snips give a clean cut with minimal bending of the flange and enable you to cut narrow strips and to make a clean cut up to the finishing edge of the bead. Use a pair of snips that are suited to you; they come in right-hand, left-hand, and straight cuts. Straight cut snips are most common.

When cutting bead, cut each flange in one motion to get a smooth cut. Short cutting

strokes produce a ragged cut that prevents a clean joining of the bead. Cut the flanges as close to the finishing edge as possible. If the bead is not cut all the way through on both sides, bend the bead back and forth till it breaks. A rough edge will result but it can be placed at the bottom of the wall.

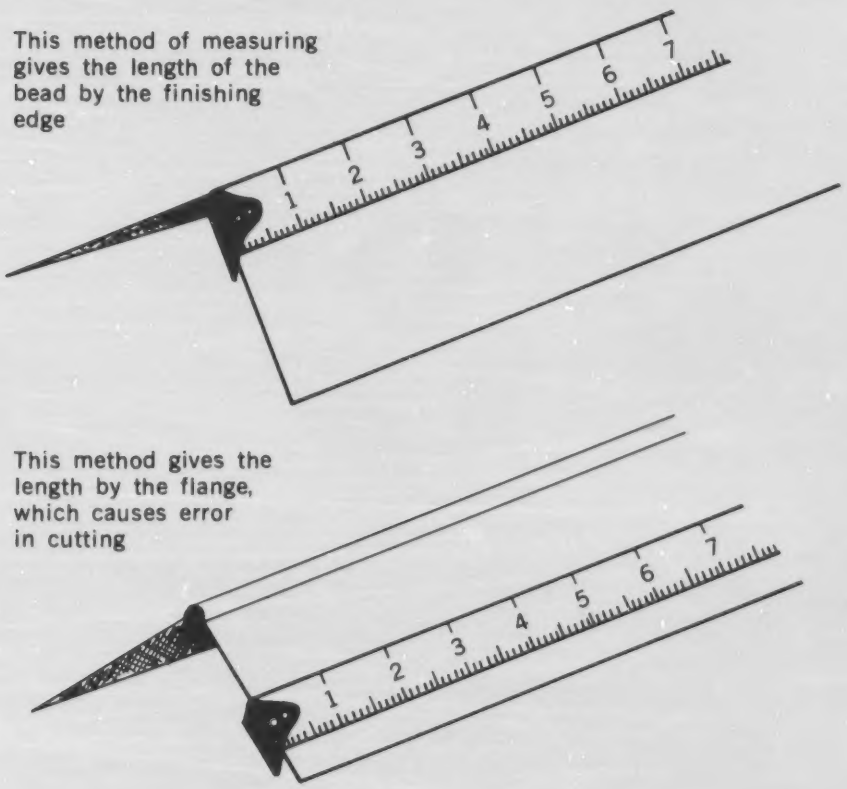
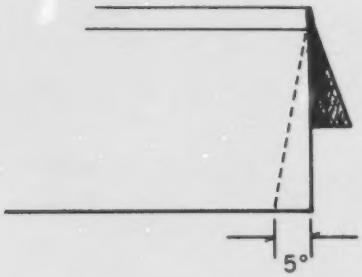


Figure 3-12
Measuring Bead

A regular tape measure will do for measuring the beads, but a fairly stiff one is easier to work with. Corners can be measured with a tape and the length transferred to the bead. Measure the bead at the finishing edge for greater accuracy (Figure 3-12). The bead can also be held up to the corner and marked, but of course this works only when there is enough room to put the bead flush against the wall. If the bead is held at an angle to the corner, you may cut it too short and waste material.

Vertical and Horizontal Lengths

Vertical bead that goes to the floor can be cut 5 mm shorter than the required length. This ensures that the bead will not bind when put in place. The bead should be pushed tight to the ceiling to leave the small gap at the bottom. The finished floor will cover the gap. Horizontal or vertical beads for corners with closed ends and no intersecting beads should be cut within 2 mm of the required length. This allows for an easy fit; too tight a fit may cause the bead to buckle. The bead should be placed so that the 2 mm gap is shared by the two ends.



By slightly cutting back the flanges, the finishing edges of two beads will butt tightly together in a straight line.

Figure 3-13
Cutting Bead

Straight Line Joins

When joining two pieces of bead in a straight line, it is helpful to cut the flanges on a slight angle away from the joint (Figure 3-13). The finishing edges, on the other hand, must be cut square so that the two beads align without leaving a gap. A gap will cause a defect in the finished bead because filling cannot make a continuous line between the two beads.

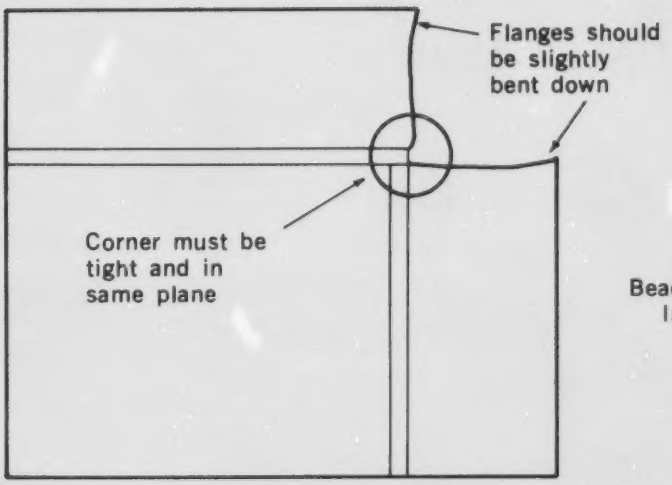
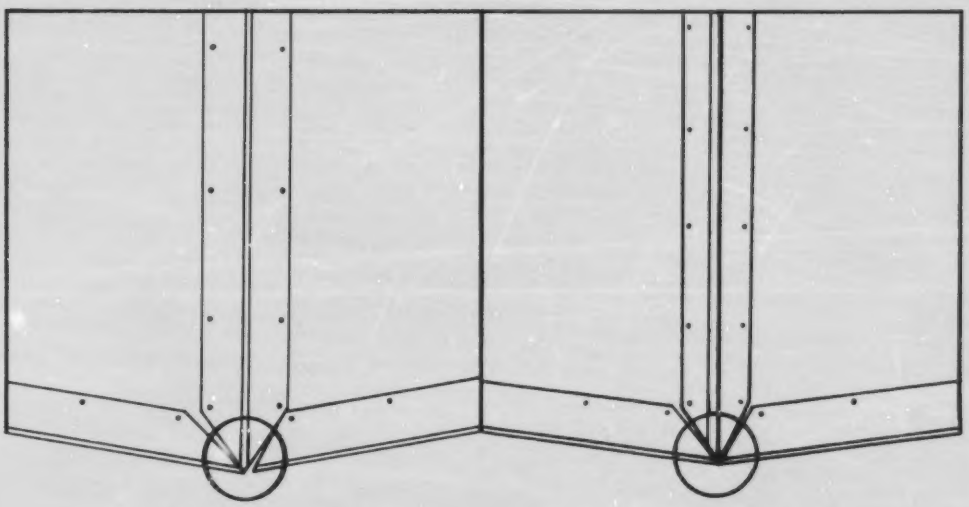


Figure 3-14
Bead Intersecting at Inside Corners

Bead Intersecting at Inside Corners

Bead that meets at an inside corner such as at a window or closet opening should be cut to fit tight so that there will be no gap between the finishing edges of the bead at the corner. When cutting bead for inside corners, cut the inside flanges back a little so that the flanges do not interfere with the fit of the finishing edges. Note that mitring is not necessary on inside corners.

For rectangular openings beaded on all sides, the horizontal beads are the first to be measured and attached. Then the vertical beads are measured and put in tight against the top and bottom beads. It is important that the ends fit tight and are on the same plane (Figure 3-14). For rectangular openings when three sides are beaded such as closets, measure and attach the two vertical beads, then the single horizontal bead.



WRONG!
A poor cut of a flange will not allow the finishing edges to touch

RIGHT
The three finishing edges all touch at a point

Figure 3-15
Beads Intersecting at Outside Corners

Beads Intersecting at Outside Corners

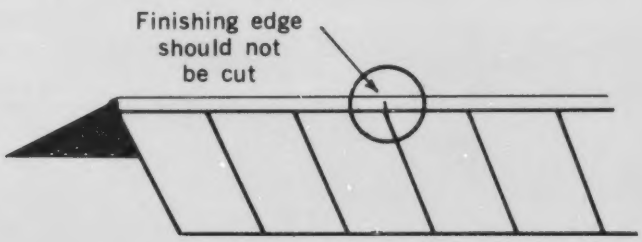
At an outside corner such as found on kitchen drops or pony walls three corner beads meet. Since these three corner beads must intersect at a tight point, the three beads must be mitred. (If the beads were simply overlapped there would be a gap at the point.) The mitre angle of the beads should be slightly less than one half of the angle of the outside corner. For example, if the corner is 90°, the bead should be cut slightly less than 45° so that the flanges will not contact and cause the finishing edges to stay apart (Figure 3-15). Note that the mitre angle must follow right through the finishing edge so that the three finishing edges actually come to a point (Figure 3-15).

When measuring bead for outside corners where only one end is mitred, measure the lengths allowing for a 2 mm gap at the unmitred end. Make sure to measure on the finishing edge of the bead. If both ends of the bead require mitring, measure the bead slightly longer than it should be and cut one end to fit tight when you attach the beads.

Check the corner for plumb before applying any bead. If one of the sides is not plumb and straight, apply that side first making necessary adjustments to correct the problem. Then match the other two beads to it. If the corner is straight and plumb, measure and attach one horizontal bead first. The point of the bead should go beyond the corner by a distance equal to the height of the finishing edge above the surface of the wallboard. This establishes the point for the corner, and the other two beads can be measured from it.

Beads on Round Structures

To apply bead to round structures, measure the circumference of the round and cut a length of bead a little longer than the circumference. The bead can be cut to fit after it is attached.



Cutting a bead to fit the
inside of a round opening

Figure 3-16

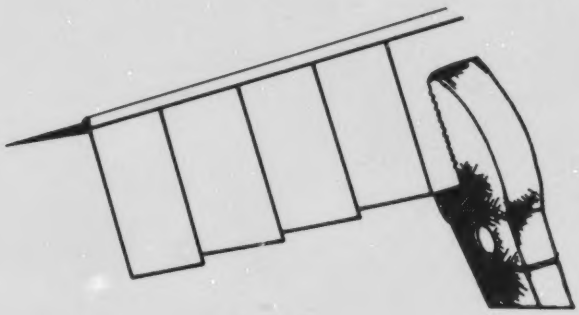
Pieces cut out of a bead to permit
contraction of the flange when
fitting the bead around
the outside of a round object

Figure 3-17

In order to bend bead, the flanges must be cut. Be careful not to cut into the finishing edge of the bead. (Cutting the finishing edge is done only when the opening or object is too small to permit the bead to bend smoothly.) If you cut the finishing edge, it will kink more readily when you bend the bead and you will create a problem when filling since the blade will ride on the cuts and produce a rippled finish. To cut bead for the inside of a round opening, make a straight cut in the flange (Figure 3-16). To cut bead for the outside of a round structure, cut pieces out of the flange to allow for contraction (Figure 3-17). The distance between the cuts will depend upon the circumference of the structure: the larger the circumference the greater the distance should be between cuts.

Pliers used to flatten a cut flange before the bead is applied

Figure 3-18



Before applying bead to a round, flatten the flange. This is necessary because during cutting the flange twists slightly, bringing one edge of the cut above the plane of the finishing edge. Use pliers or end-nippers to flatten it out (Figure 3-18).

Start at a point on the round where the join in the bead is least likely to be seen. Fasten one end of the bead and continue fastening the bead around the circumference. Because of the cutting on the flanges, the bead should bend quite easily to fit the round. Make sure that the bead is adequately fastened. The tighter the radius the closer the bead should be fastened. If fasteners are too far apart the bead will block, kinking the finishing edge and creating a flat spot in the circle. Once the bead is fastened in place around the entire circumference, use the handle of a hammer or something similar to lightly tap the finishing edge to remove minor flat spots. Be careful, though, not to break or dent the finishing edge.

Plumb, Level and Straight

Before plumbing or leveling a bead, do some investigation since it is possible to make things look worse than they originally were. If a nearby line that is not level or plumb can be lined up with the bead you are working on, the problem will be amplified, not corrected. Some lines to look for are door openings, window openings, and other corners. In such a situation, it is probably best to make the bead parallel with the existing line. The two parallel lines will give the appearance of being plumb or level.

Similar exceptions do not apply to being straight: all bead should be put on straight, i.e., the bead should not be bowed in or out anywhere along its length. Bead can always be checked for straightness with a straight edge or a string line.

To plumb a bead you need a 2 mm level or a shorter level attached to a long straight edge. Before the bead is put in place, check the corner with the level to find where the corner is out of plumb. If, for example, the top of a corner is angled away from the vertical, attach the bead at the bottom first. Then using the level to keep the bead plumb, attach the top. Continue to use the level or a straight edge while attaching the bead between the two points to ensure the bead is straight. Note that there is a limit to how much you can pull a bead out to correct an out of plumb corner. Too much and the fasteners won't be able to make contact with the stud, or in the case of glue on bead the bead won't contact the wallboard properly.

Problems can arise trying to keep a long horizontal bead (over 3 m) straight. To ensure that the bead is straight use a chalk line as follows:

1. Assuming that the corner is level, snap a chalk line along the corner. The line should be the width of the flange away from the corner. If the corner isn't level and you wish to make it so, you will have to put a level on the chalk line. To get a level line, always fix the chalk line at the low side and adjust the line down from the high side.
2. Trial fit the bead to see if it overlaps or is short of the chalk line.
3. If the bead and line are off, make adjustments and snap a new line.
4. Fasten the flange on the line.

Attaching Metal Corner Bead

As stated earlier there are three common ways of attaching metal beads — nailing, screwing, and clinching (Figure 3-19). In the past nails were most common, but the popularity of screws is growing. Clinching is generally used on steel studs but also can be used on wood studs. Because clinching forces tangs of metal into the wallboard but not into the framing member, the bond can be only as strong as the core of the board. The bead can be easily knocked off the corner. To improve the bond of metal bead that is to be clinched, glue (not filler) is often applied to the inside of the corner bead. Clinching should be used only when the corners are straight and plumb.

Nailing or Screwing

To nail or screw corner bead:

1. Place the bead with the square cut end tight to the ceiling.
2. Square the bead on the corner.
3. Starting about midway up the bead, lightly tap the finishing edge of the bead into the apex of the corner to ensure that the bead is tight and squared against the wallboard; then hold the bead against the wallboard.
4. Fasten both sides of the flange at this point directly opposite from one another. This prevents the bead from twisting.
5. Repeat this taping, holding and fastening every 30 cm until you reach the ceiling. Maintain an even pressure on the bead and keep it square. Nails may be driven through the holes in the flange, or they may be driven through the metal. Driving the nails through the metal gives a tighter fit. Nails may be driven anywhere on the flange but screws should be placed only on the outer edge of the flange.
6. Double fasten (i.e., use two sets of nails or screws) the end of the bead at the ceiling.

7. Return to the mid point and similarily fasten the bead about every 30 cm until you reach the floor. Double fasten at the floor.

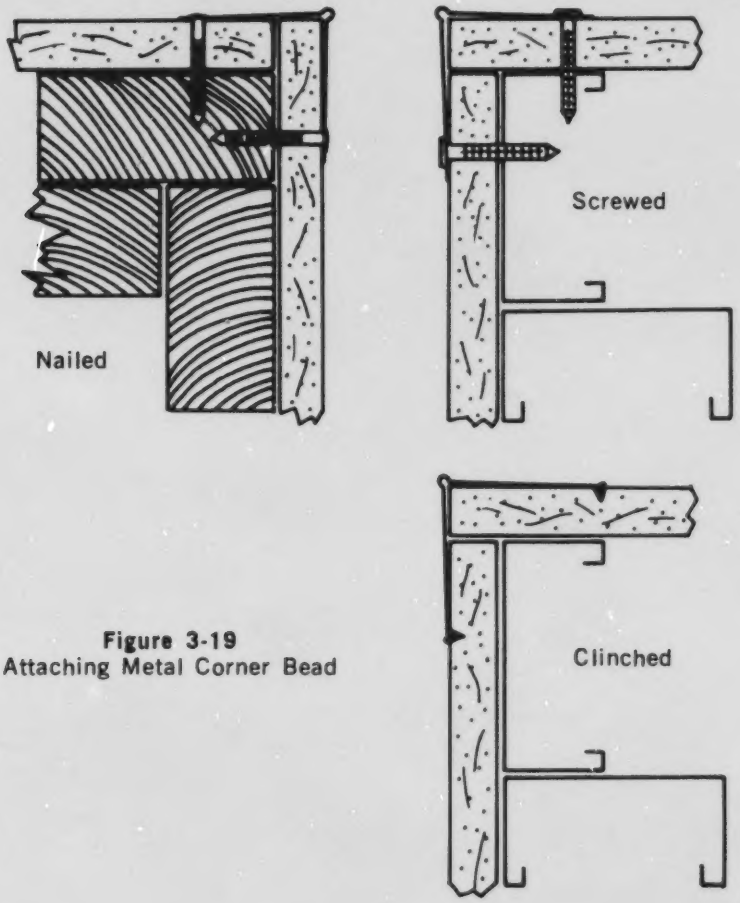


Figure 3-19
Attaching Metal Corner Bead

When joining pieces of bead in a straight line, fasten all but the last foot of each one. This allows a bit of give to align the finishing edges. To fasten, work toward the joint, and place the last fasteners as close as possible to the ends of the beads.

A common problem with all types of bead is in keeping the bead straight as you are attaching it. There is a tendency to apply more pressure in the space between your shoulders and waist because that is where you can apply pressure comfortably. Unfortunately, this shows up as a fault in the bead as it will be tight in the middle but bow out at the top and bottom where you were not able to keep the pressure uniform. To check yourself you may want to use a straight edge. With practice you can learn to maintain a constant pressure for the length of the bead.

Clinching

Before using the clincher, make sure it is in good condition. Down the middle of the angle is a groove into which the finishing edge of the bead fits. This must be clean to enable the bead to sit squarely and to let the teeth dig into the wallboard to their maximum depth. Over a long period of use this groove will wear and the clincher will not fit tight to the bead. The sloppy fit causes the clincher to slide from side to side and make the bead twist. Twisted bead cannot be repaired so the whole piece must be replaced.

Check that the teeth are pointed so that they can make a clean bite into the bead. The bolts that hold the teeth in place should be tight but the mechanism should not jam. The head of the clincher should move freely up and down. It helps to lightly oil the moving parts. Too much oil, however, will mean that oil will get on the bead and will cause problems with the adhesion of the filler to the bead.

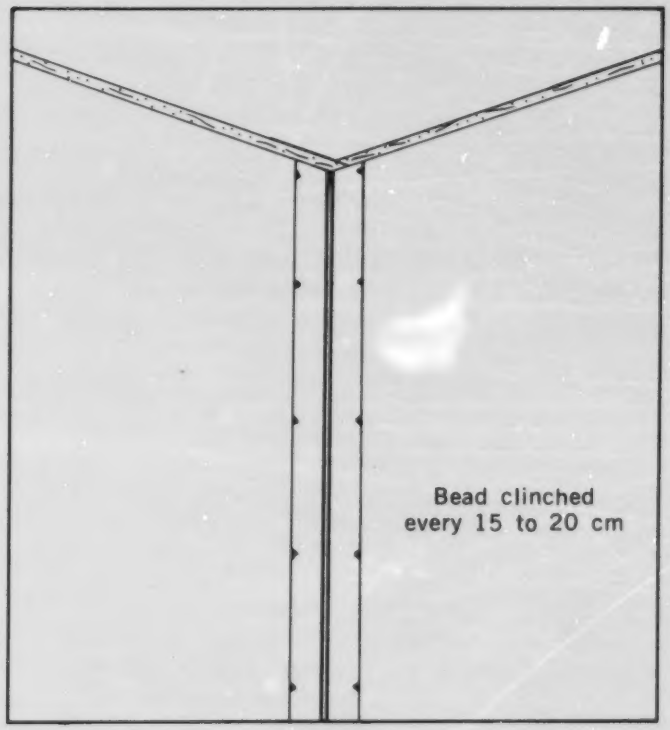


Figure 3-20
Clinched Bead

To clinch metal corner bead:

1. Make sure that you have the right size clincher. Clinchers come in different sizes to match the different widths of bead flanges.

2. Start at about the mid point of the length of the bead.
3. Place the clincher against the bead and tap the body of the clincher with a rubber mallet to push the bead tight and square against the wallboard.
4. Strike the head of the clincher with the mallet. Check to see that the teeth have dug in about 3 mm; if not, strike the head again. Don't strike the clincher too hard as you can damage the finishing edge of the bead.
5. Move the clincher towards the ceiling striking the head every 15 cm to 20 cm (Figure 3-20). Maintain an even pressure on the bead and keep it square. Avoid hitting nails or screws with the teeth of the clincher because you may damage the teeth.
6. Clinch the bead about 3 cm from the ceiling.
7. Return to the mid point and similarly clinch the bead every 15 cm to 20 cm until you reach the floor. Again clinch about 3 cm from the end of the bead.

The 3 cm from the ends of the bead also apply when joining bead. This allows you to watch the alignment of the two heads and prevents the clincher from drawing the ends of the bead down.

Stapling Veneer Bead

Staples are not recommended for fastening ordinary metal bead because they cannot be driven in far enough to securely attach the bead. Also, the finishing edge of metal bead is not raised enough to clear the staples, and this would cause the trowel to contact the staples when filling.

Veneer bead, on the other hand, has a mesh flange that allows filler to bind the bead to the wall. Staples are used to hold this bead in place for filling. The staples should be placed 15 cm to 20 cm apart. The finishing edge of veneer bead is raised enough so that a trowel can clear the staples.

As already mentioned the main use of veneer or mini bead is to straighten bowed or out of plumb corners. To attach mini bead:

1. Place the bead tight to the ceiling.
2. For bowed in corners staple both ends of the bead. For bowed out corners staple at the furthest point out on the bow. For out of plumb corners staple at the end that is angled out.
3. Adjust the finishing edge to a straight edge and level to ensure that the bead is straight and plumb.
4. Staple the sides of the flange directly opposite each other every 15 cm to 20 cm.

Attaching Glue-On Beads (Paper, Screen and Flexible Corner Beads)

Glue-on beads are more difficult to apply than metal beads. There are many factors that influence the attaching of the bead such as drying conditions, the bonding capability of filler, the bond of the paper tape to the metal of the bead, and the skill of the applicator.

There are three main methods of applying glue-on bead: pan and knife, hopper, and corner tool and roller. All three methods can be used for applying paper or screen corner bead, but flexible bead should be applied only by the knife and pan method. A 15 cm

1. Applying filler with a corner tool

2. Placing the bead on the angle

3. Imbedding the bead

4. Wiping the bead

5. Wiping the bead

Figure 3-21
Applying Glue-on Paper Bead

knife should be used when applying beads by hand. A general rule is to use the hand method when applying one to ten beads. For more than ten beads, use one of the other two methods.

The hopper for glue-on bead is very similar to the taping hopper except that the gates are V-shaped to match the angle of the bead. By raising or lowering the gate you can regulate the amount of filler applied to the bead. The corner tool is a V-shaped blade a little more than 90° with a handle attached. The corner tool applies filler to both sides of the corner at the same time. An exterior corner roller is then used to imbed the bead into the filler. The handle of the roller must centre on the corner to ensure correct attachment.

Before applying glue-on bead it is a good idea to check the surface it is being applied to. The surface should be free of grease, oil, and dust and more important, the surface should be solid. The paper must adhere to the core of the board or else the bead will not fasten securely and will eventually crack and peel off. Remove any loose paper and broken core and prefill with a fast setting material. If a beveled edge of the wallboard is at the corner, prefill the bevel. Otherwise the finishing edge of the bead will be below the surface of the board. Do any necessary straightening of the corner with prefill before applying the bead. This is especially important when flexible bead is used on external angles greater than 90° because these angles are a focal point of attention. Make sure that at the intersection of the two sheets of drywall the overlapping sheet does not protrude past the other sheet. In fact, for glue-on beads it is a good idea to cut back the overlapping sheet 2 mm or more for penetration of the filler.

When attaching bead with filler, it is essential to get the right consistency and thickness of the filler. With the hopper method, the filler should be of the same consistency that is used for applying tapes. With the pan and knife and the outside corner tool methods the filler should be slightly thicker for ease of application. The filler must be able to penetrate the tape on the bead and the surface of the wallboard. If the filler is too thick the bead won't imbed tightly to the wall and will leave the flange sitting too high to be covered when filling. Note that if fast set filler is used the consistency of the filler is thinner than for slow set.

For the best results in a minimum of time, the thickness of the filler should be as close to 2 mm as possible. Less than 2 mm and there will not be enough filler to bond the tape; more and the process will become too messy and the flange may sit too high which could cause edge-cracking.

The bead should be applied as soon as possible after the filler has been applied. If the bead is left until a film has started to form over the filler, a poor bond will result. Under normal drying conditions the bead should be allowed to dry for 24 hours before it is filled. There are two reasons for this. One is that if you fill the bead before it is dry, the flange will lift and interfere with successive coats. The second reason is that the paper of the bead will be wet.

To apply paper, screen, and flexible glue-on beads to external corners or angles (Figure 3-21):

1. With flexible bead, bend the bead slightly more than is required.
2. Apply filler. When using a knife or corner tool, apply filler to both sides of the walls to a depth of 2 mm. Make sure that there are no dry spots and that the apex of the corner is covered. When using a hopper, adjust the gate so that 2 mm of

filler lines the inside of the bead. Also make sure there are no dry spots.

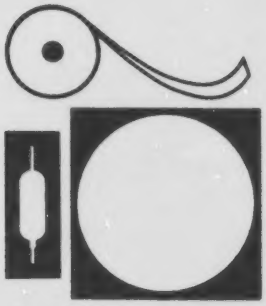
3. Place the bead on the corner or angle and with an up and down sliding motion set it in place tight to the ceiling. Make sure the paper flanges don't curl under. Notice that the bead has uneven lengths of metal flange on the inside. By putting the longer of the two over the overlapped side, it will contact the wall surface and help square the bead on the corner.
4. Imbed the bead in the filler. When imbedding by hand, press on the part of the flange that has the metal backing. Press the bead into the apex of the corner or angle with equal pressure along the entire length of the bead. When using a roller, place the roller about half way up the bead with the handle bisecting the angle. Applying even pressure, run the roller to the ceiling, then down to the floor, and finally up to the ceiling again.
5. Check that the bead is straight and plumb. This step is more important with flexible bead because lacking the rigidity of paper bead it is more likely to wander. When applying flexible bead to angles longer than 3 metres, use a dryline as a guide to keep the angle straight. This is done by attaching a string to two nails one at either end of the angle. The string is then drawn tight and the bead is adjusted to the string.
6. Wipe the flanges of the bead to remove the excess filler. Make sure that the paper is wiped tight to the board and the edges are feathered.
7. Clean the finishing edge of the bead with a blade. Be careful because the action of the blade running on the wet paper can cause the paper to burr and in some cases tear. Such damage if done to the finishing edge is impossible to repair and is unacceptable. It shows a glaring fault in the bead when painted.
8. Check that the finishing edge is above the wall surface and adjust as necessary.

SUMMARY

- Common corner beads are: metal, veneer, paper, screen and flexible.
- Metal and veneer beads are applied by nailing, screwing, or clinching.
- Glue-on beads (paper, screen, and flexible) are applied with filler.
- Common types of edge trims are L-bead and J-bead (metal and plastic).
- Measure bead on the finishing edges, not on the flanges.
- Vertical bead that goes to the floor can be cut 5 mm short. Leave the 5 mm gap at the floor and place the bead tight to the ceiling.
- Lengths of bead between drywall should be cut to have a gap of 1 mm at each end.
- The finishing edges of joined beads must be square and touching.
- The finishing edges of beads meeting at inside corners should be tight together.
- Where three beads meet at an outside corner the beads must be mitred and the three finishing edges must touch.
- Flanges have to be cut when beading round structures.
- All bead should be applied straight, and in most cases, plumb or level.
- Follow the correct procedures for nailing, screwing, clinching or stapling (veneer) bead.
- Follow the correct procedures for attaching glue-on beads.

EXERCISE

1. What are the advantages and disadvantages of metal corner beads?
2. What are the advantages and disadvantages of glue-on beads?
3. What are common uses for:
   - L-bead
   - J-bead
   - Plastic J-bead
   - Veneer bead
   - Flexible bead
4. If the length of an outside corner, floor to ceiling, is 2390 mm, what length should you cut the bead?
5. Why must the finishing edges of beads fit tightly together for straight line joins and for intersections at corners?
6. At what angle do you cut the three beads that intersect at an outside corner?
7. What are the two methods for ensuring that a bead is put on straight?
8. What must be done to a bead to make it fit a round structure?
9. Where is a vertical metal bead first fastened?
10. What fastening treatment is required at the ends of bead?
11. When clinching a bead, clinches should be made every ——— cm and ——— cm from the ends.
12. Where is veneer bead first stapled for a bowed in corner? A bowed out corner?
13. What are the three methods for applying glue-on bead?
14. Why must care be taken when wiping the finishing edge of paper and flexible bead?
15. Why is it important when attaching all types of bead to apply even pressure all along the bead?



Taping and Wiping Tapes

MODULE 4

INTRODUCTION

Taping is the process of gluing or otherwise adhering a paper or gauze tape over wallboard joints: butt joints, flat joints and angle joints. Taping reinforces the joints and provides a solid flat surface for the application of further coats of filler. The reinforcement of joints with tape prevents cracking of the finished surface caused by stress from the normal vibrations and movements from settlement of the building and expansion and contraction of construction materials. In addition to sealing joints and cracks, the tape also creates a barrier that retards the spreading of a fire to other rooms.

Tape is also used over holes, cracks in the surface paper of the board, areas where the surface paper has been stripped to the gypsum core, and damaged areas around fasteners. In these cases the tape is needed to cover the core and retain the surface strength of the board.

This module is divided into three sections: Hand Taping, Machine Taping, and Wiping Tapes. Each of the sections has its own set of questions.

Hand Taping

Tape

Paper tape is a cross fibre kraft paper that has proved to be the best reinforcing material for drywall use. It is usually 5 cm wide, cream-colored, spark-perforated, creased down the centre, and buffed on the edges of one side. The combination of these properties makes the tape inexpensive, strong, and highly versatile. The cross fibres provide strength in all directions, reducing the chance of a crack forming. The fibres also enable the filler to penetrate the tape and provide a secure bond. The width of the tape is sufficient to cover the joints and to leave enough tape on either side of the joint for a secure bond to the wallboard. The spark perforations permit air to escape when the tape is being wiped; they also permit filler to pass through to the top of the tape giving a strong bond. They may also help the drying process by permitting air to contact the filler. The crease down the centre makes it easier to fold the tape for angles. The buffing reduces the thickness of the tape near the edge, lessening the incidence of edge-cracking. The buffed edges taper off so that less filler is needed to blend the tape into the wall. Note that the buffed side of the tape always goes against the wallboard.

A gauze tape can also be used on wallboard but only on non-bearing, steel-stud walls. These walls are structurally stable because there is no weight on them and they cannot move or work as do wood walls. Gauze is not recommended on non-bearing wood walls because it provides little reinforcement and if the wood is wet, the wall will work and crack the joints. Besides non-bearing, steel-stud walls, gauze can be used for small patching jobs.

Gauze tape is made of glass fibre to prevent rotting and is coated on one side with pressure-sensitive adhesive. The adhesive bonds well and is not subject to failure. Gauze is a very difficult tape to use on angles because it does not crease evenly.

Pre-Filling

Prior to taping, the joints should be checked for problems such as wide gaps and broken corners. These problem areas should be pre-filled before tape is applied. Pre-filling is discussed in Module 5, Filling.

Dry Method Hand Taping

Dry method, also called butter method, taping is the most basic form of taping. A dry tape is embedded by hand into filler that has been applied over a joint or hole in wallboard. Dry method taping is a one-person operation that requires few tools and little clean-up time. This makes it ideal for small jobs where there may be only a few flats and angles to tape. Because of the smallness of the tools, dry taping is suitable for confined areas where only limited movement is possible. The disadvantage of this method is that it is slower than mechanized taping. It is therefore not practical for production work where maximum output must be achieved in minimum time.

Machines are available for dry method taping that speed the process slightly, but as with any machine cleanup time is a factor. For small jobs the extra cleanup time required with these machines outweighs the saving in working time. On the other hand, dry taping machines can be used to advantage when taping a house or similar size job.

Tools

Tools needed are a knife, pan, and tape holder (Figure 4-1). A hawk can be used in place of a pan but is not recommended because taping filler is thin and difficult to hold on a hawk.

Figure 4-1
Knife, Pan, and Tape Holder

Consistency of Filler

For dry method taping the consistency of the filler should be smooth and stiff enough so that it can be held on the knife, yet soft enough to spread easily. It should flow smoothly under the blade of the knife to feather the edges and impregnate the perforations of the fibres of the tape. To test if filler is right for taping make a trough by running your finger through it; the filler should immediately flow to fill in the trough leaving only a slight depression.

Taping System

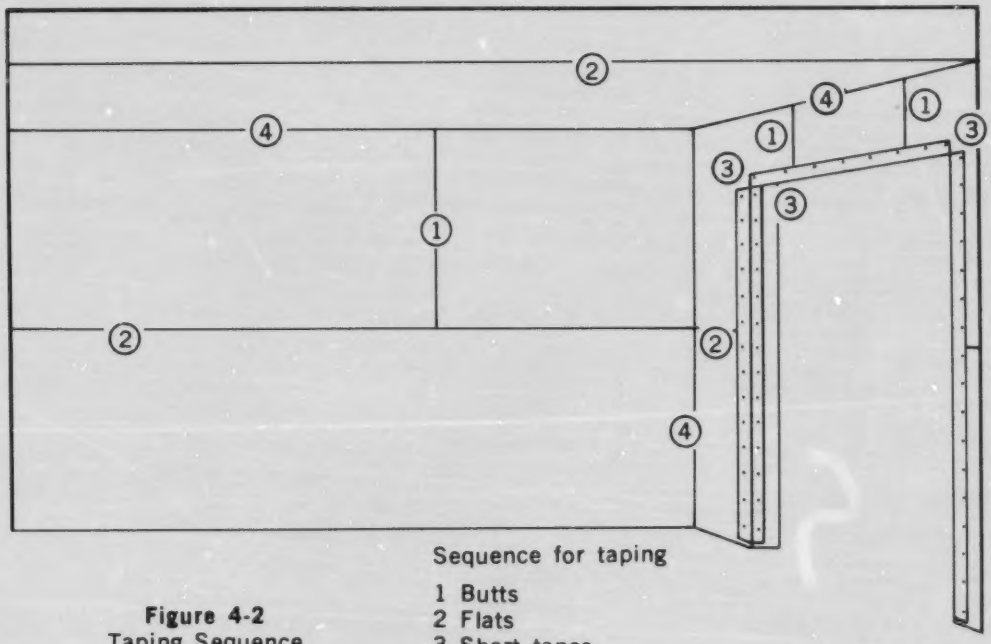
One system with dry taping is to tape what can comfortably be reached in the room from the floor and then to use stilts to complete the upper part of the room. Another system is to stand on something to reach the top of upper butt joints and vertical angles in order to complete the walls, then to put on stilts for the ceiling. A bench with a wide, stable base is best to stand on. Pails or narrow-based benches are unsafe.

Spreading Filler on Joints

The amount of filler spread on a joint before applying tape is critical for a fast, clean job. The filler should be 2 mm thick for butts and angles and 3 mm for flats to ensure enough filler to bond the tape to the wall. The filler should be applied just slightly wider than the width of the tape. Applying more filler means that more has to be wiped off taking additional time and leaving a messier looking job.

Dry Taping Butt Joints

Butt joints are the first joints to be taped on a surface because the ends of the butt tapes can then be overlapped by the flat and angle tapes. This leaves the bottom of vertical joints, which are usually covered by baseboards or the pile of the carpet, as the only exposed ends of tape. Figure 4-2 illustrates the correct taping sequence: butts, flats, short tapes, and angles.



Sequence for taping

1 Butts
2 Flats
3 Short tapes
4 Angles

Figure 4-2
Taping Sequence

All tape, no matter how it is applied, should be no further than 1 cm from a joint or the apex of an angle, and no further than 1 cm from the floor. The tape should not go across a joint or angle to the other piece of wallboard.

To tape a butt joint:

1. Before the filler is loaded over the joint, check that there are no pieces of paper, plastic, or broken board that could cause a poor bond between the surface of the board and the tape. Also, if pre-filling has been done, check to see that it is hard.

2. Load filler over the joint, making sure that the swath is slightly wider than the tape (Figure 4-3) and the filler is at least 2 mm thick.
3. Starting from the top, lay the tape, buffed edges down, into the filler. One hand pulls the tape from the roll and holds the tape while the trailing hand presses the tape into the joint. The taped joint will have a slight crown in the centre because the tape tapers from the centre out to both edges on the bottom side. The difference in height between the tape and the board is barely noticeable and the filling of the butt joint later will compensate for it.
4. Cut the tape by placing a knife blade on the tape and ripping the tape against the blade.

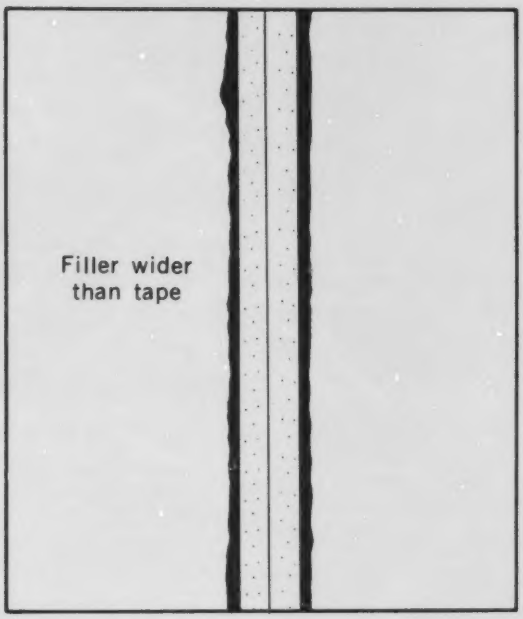
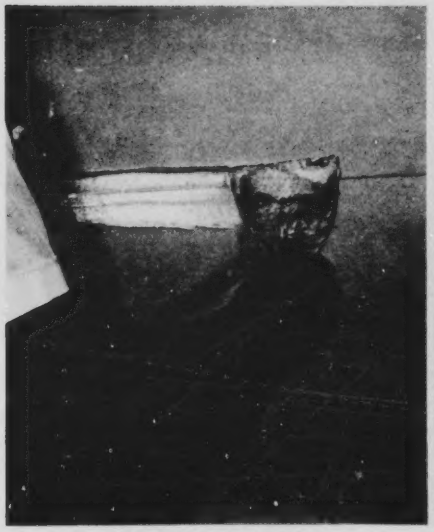


Figure 4-3

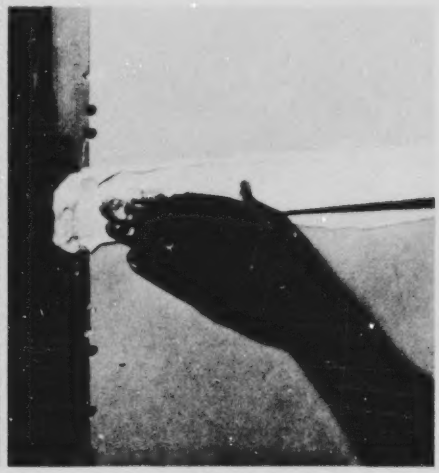
Dry Taping Flats

Flats are taped by the same method used for butt joints. The filler should fill the bevel and be at least 3 mm thick. Put filler on one flat at a time and then tape the flat before moving onto the next one (Figure 4-4). If you try to fill several flats at a time, the filler forms a dry film on the surface that leaves a weak bond between the filler and the tape. Remember, the tape should be no shorter than 1 cm from the apex of an angle and should not be curved over the angle onto the adjoining wall flat. At external angles tape should overlap the bead flange but should not go over the bead finishing edge (Figure 4-5). Cut tape as close as possible to a right angle so that the entire end of the tape can be covered by an overlapping tape.

Note that all the butts on a surface in a room can be done first, then all the flats. Another method is to tape all the butts on all the surfaces in the room, then do all the flats.



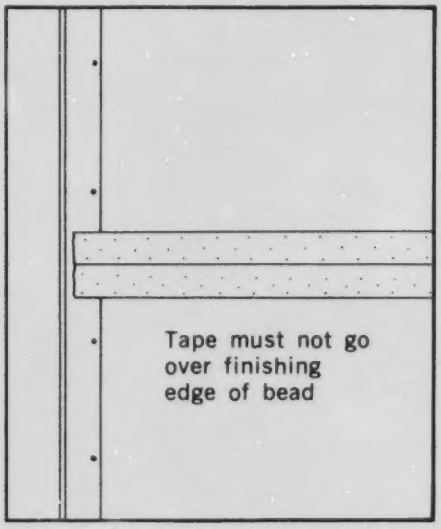
1. Applying filler



2. Imbedding the tape

Figure 4-4
Dry Taping a Flat

Figure 4-5



Applying Short Tapes

Short tapes are used for reinforcement over holes, damaged wallboard, around nails or screws, and around light boxes and pipes. They are also used to reinforce corners and angles in archways, to bridge gaps between the edge of a bead and the edge of a board, and to reinforce J-bead on valances and closet openings so that cracks don't form along the edge of the bead.

Points to note when applying short tapes are:

1. Always remove any loose bits of wallboard before applying a short tape.
2. Make sure you apply at least 3 cm of the short tape to a solid surface at either end of the hole or gap.
3. When applying tapes over holes, put filler on the backside of the tape, not on the wallboard. This will make the tape more solid once the filler dries.

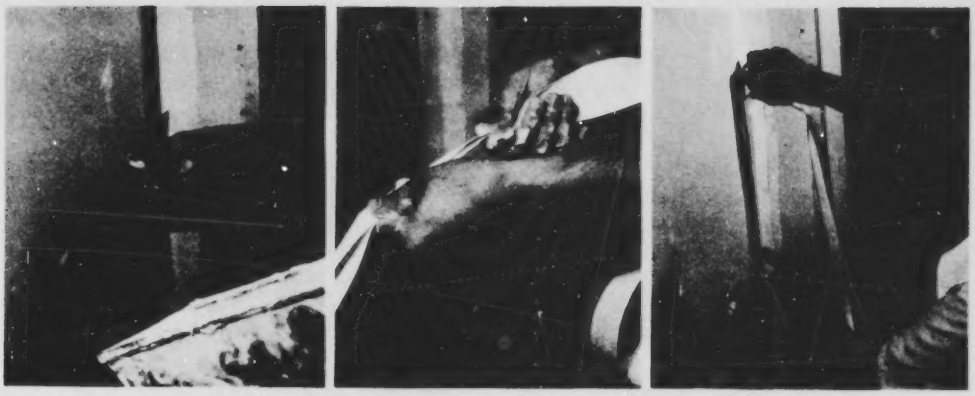
Figure 4-6
Laminating Short Tapes

4. When more than one short tape is required to cover an area, laminate the tapes together with filler, then apply them to the wallboard. This prevents cracking along the overlapping edges of the tapes. You can use the wall near the hole as a surface on which to laminate the tapes (Figure 4-6). Be sure to clean off the wall after lifting the laminated tapes and applying them over the hole or gap.
5. Short tapes must be placed around electrical outlets when there is a gap of more than 3 mm between the edge of the board and the box. It is best not to extend the edge of the tape over the edge of the box as this hinders the work of the electrician and can lead to the tape cracking when the fixtures are put in. If the width of the gap exceeds 2 cm, apply two tapes.
6. Only two tapes should be necessary to cover a hole around a pipe. Place your thumb on the tape and rip around it to form a semi-circle. Put this tape around the pipe on one side. Follow the same procedure on the other side and slightly overlap the second tape. If there is a gap on the outside edge of the tape, add an extra tape to cover it.

Dry Taping Angles

After the butts, flats and short tapes are applied, put on the angle tapes:

1. Place with a knife a layer of filler wider than half the tape on each side of the



1. Applying filler 2. Creasing the tape 3. Imbedding the tape

Figure 4-7
Taping an Angle

angle (Figure 4-7). The entire surface contacted by the tape must have 2 mm of filler on it, slightly less than for flats.

2. Make a sharp crease in the tape, creasing so that the buff side will be down when the tape is layed in the angle. A crease is essential if you are to get a square angle. To crease the tape either use a commercial creaser or fold it as it passes through your thumb and index finger (Figure 4-7).
3. Lay the tape into the angle (Figure 4-7). Vertical angle tapes are usually applied from top to bottom. If you cannot reach the top of the angle a joint can be made in the tape; however, the joint should be made in a spot where there won't be a buildup or ridge. Angle tapes should reach to within 1 cm of the floor and fit tight at the threeway. If there are gaps greater than 1 cm at places between the two boards, cover the length of the gap with a creased tape, then apply another tape to cover the full length of the angle.
4. Some angles are rounded rather than square. For round angles, do not crease the tape. Overload the angle with filler to ensure the tape will adhere to the wall. Do not press the tape in place when laying it in because doing so could cause an uneven surface that would be difficult to wipe evenly into a smooth arc.

Cleanup Procedures

Following the standard cleanup procedures, check the walls and floor for spilled filler. With dry method taping there should be less wall and floor cleanup than with the other methods of taping because one person usually carries out the complete taping process and is more aware of any spills. Cleanup of the tools involves cleaning the knife, pan, pails, and mixer, all of which should take no more than five to ten minutes.

Hopper Method Hand Taping

A hopper consists of a V-shaped trough with a horizontal slot on the bottom for tape to pass through (Figure 4-8). Filler is poured into the trough and the tape pulled through. The hopper is an efficient method of taping because it combines the two procedures of dry taping into one procedure: both the filler and the tape are applied in one step. Also, the filler has more time to soak into the fibres of the tape than in dry taping.

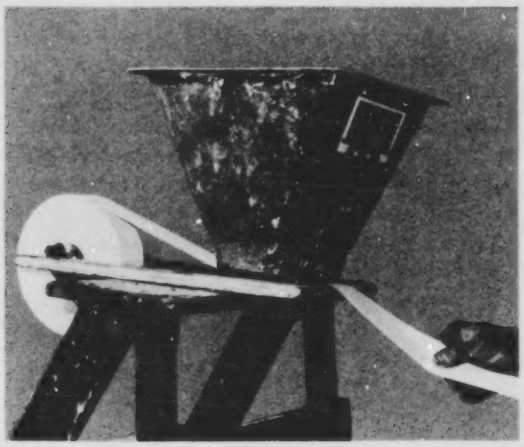


Figure 4-8
Hopper

This method of taping is ideal for low-volume companies because it gives good production and the initial output of money for the hopper is minimal. There are no moving parts, thus almost eliminating maintenance work on the hopper. Cleanup with a brush and pail of water doesn't take long because every part is easy to get at; and if a hose with running water is available even this short time can be cut in half. Clothes, however, can be harder to clean because the hopper method of taping can be messy. For this reason a plastic apron is recommended to keep clothes clean.

An advantage of hoppers over taping machines is that hoppers can hold more filler than any of the machines and therefore you can apply more tape with it between refills. Your physical strength and height are the main limitations with hoppers. Another advantage with hoppers is that you are closer to the surface of the board than with machines making it easier to see surface defects in the board and tape them as you go.

With the hopper method a room is taped in two processes. First, everything from the floor to as high as can be comfortably reached is taped. Second, the upper part of the room is taped on stilts. This need for two processes is a disadvantage when compared with machine taping where the complete room can be taped from the floor in one operation.

The disadvantage of hopper taping on stilts is that unless a helper is used it is slow. The lone taper must get off the stilts, mix the filler, add it to the hopper, and then get back on the stilts. However, even with these delays, the hopper method still saves time over dry taping.

It is a good idea to wear rubber gloves when applying tape with a hopper to protect your hands from the abrasiveness of the filler, tapes, and the surface of the board. Fingernails can be very painful if worn down too short.

Positioning the Hopper

There are two ways of positioning a hopper: on a bench usually waist-high, or nailing the hopper support board to the inside of an archway. The latter means is preferred because it is easy to get at the hopper, the hopper is solidly mounted, and the nail holes are covered by the filler when the bead is coated. In both cases the box must be firmly set in place.

Loading the Hopper With Tape

Before putting filler in the hopper, place the tape on the dowel peg and feed it through the hopper. Make sure that the underside (buffed side) of the tape is facing up and that the tape is coming off the top of the roll. A number of rolls of tape can be loaded on the hopper at once by stacking the rolls and feeding them through the hopper one on top of the other (Figure 4-9). Stagger the tape ends so that they can be easily picked up. The advantage of loading several rolls at once is that when one roll is used up the next roll just has to be put on the dowel and it is ready to go. You don't waste time trying to feed tape through a full hopper, and you don't have to worry about how much filler is in the hopper when nearing the end of a roll.

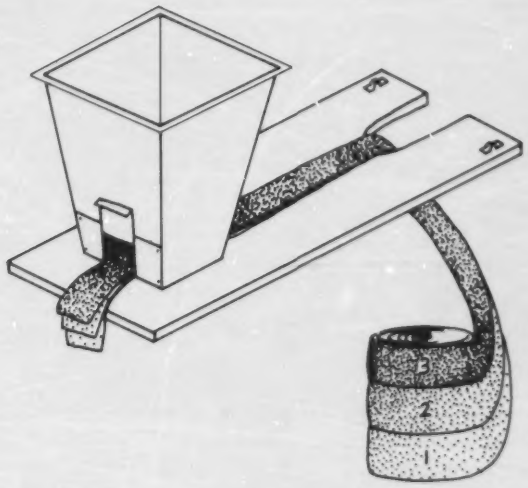


Figure 4-9
Hopper With Stacked Rolls of Tape

Filling and Adjusting the Hopper

With the tape loaded in the hopper, make sure that the gates are closed before pouring in the filler. The filler must be thin enough to pour out of the pail but not so thin that it runs out of the opening around the tape. When the filler is in, the hopper becomes top-heavy, so be sure that the hopper is securely mounted. Do not try to pour filler into the

hopper by yourself. A pail of filler weighs about 30 kg and becomes very awkward when you try to lift it above waist level. If you are 180 cm tall and weigh 90 kg, fine, but for the average physique such a heavy pail puts unnecessary strain on the body. Place an empty pail at the front of the hopper so that any filler escaping from the gate as the tape is pulled out falls into it.

Pull the tape through while you adjust the amount of filler on it by raising or lowering the front gate. At least 3 mm of filler should be on the tape for flats and 2 mm for angles and butts. If you are working with another person who is wiping the tapes, check with the wiper to make sure the amount of filler is sufficient to fill the bevel and feather out the edges without difficulty. The amount of filler on the tape should be adjusted to the wiper's preference, since the idea is to work as a team, not to show the wiper how fast you can apply tapes.

Handling Wet Tape

A pail is needed to hold the wet tape. You should also have some means of attaching the pail to yourself so that, as you move, the pail is always with you and does not have to be touched. A belt around the neck is common. It is also a good idea to carry a knife for cutting the wet tape since it is much easier to tear the tape against a knife than it is to tear the tape by hand. In addition, the knife tear can be made square.

Pull the tape with long, smooth strokes by alternating your hands to ensure that the filler is evenly applied. Pull the tape down from the hopper into the pail until the pail begins to feel heavy. There will be enough filler in it to keep the tape damp, so you do not need to worry about the filler on the tape drying before putting the tape on the wall. The size of the pail and the amount of tape put into it will depend on your strength. Leave the end(s) of the tape hanging over the edge of the pail so that it can be quickly located. It is very easy to lose the end in the pail because the bottom of the pail collects loose filler. If you have 50 m of tape in the pail it can take a long time to find the end.

Hopper Taping Walls

As with dry taping, tape in this sequence: butts, flats, short tapes, angles. With vertical flats, angles, and butt joints (both those above and below the flat), it is easier to work from the top down because the tape is pulled up and out of the pail without binding or scraping filler off the tape.

To tape wall butt joints:

1. As the tape comes out of the pail, hold it in position with one hand and use the other hand to keep it from twisting. Make sure the hand guiding the tape from the pail is not scraping filler off the tape.
2. Start the tape within 1 cm of the angle or joint. Once the tape is started and you are certain it will not slide, move down the wall with the trailing hand gently pressing the tape onto the joint (Figure 4-10).
3. At the end of the butt joint cut the tape by placing a knife on the tape and tearing the tape against the blade.

Use the same procedures for the flats.

When taping a vertical angle, it is best to use a full length of tape. A knife may help to reach the top of the angle. Make sure the tape reaches into the threeway. However, if you cannot reach the top of the angle, make the joint at a point where it will not overlap any other ends of tape. This will prevent a hump in the finish coat. Starting at the top, lay the wet tape into the angle running your fingers, the side of your hand, or a knife handle down the crease mark to crease the tape and set it into the corner.

Figure 4-10
Handling Hopper Tape

Cleaning Up the Walls

Because the tape is dangling between your hands and the pail, at times the tape will come in contact with the wall and leave lumps of filler on it. The pail will also be covered with filler and therefore should be kept away from the wall. Any filler that does get on the walls must be removed before it dries. Also, a pail of water should be kept handy to wash filler off your rubber gloves. With clean gloves the walls will be kept cleaner and it will be easier to pull tape out of the hopper and cut it at the ends of the joints.

Hopper Taping Ceilings

Once all the joints that can be reached from the floor are taped, then do the top part of the room. Try to have someone available to mix the filler and fill the hopper. If this is not possible or you are working alone, be sure to take your stilts off to mix and pour filler. You could do it from the stilts but the resulting muscle strain could put you off work for some time. It is important when taping ceilings to firmly press the tape against the ceiling, otherwise it will peel off.

If it is necessary to put tape on the top of wall butt joints, put the tape over the end of the previous tape. Also do this with any angle tapes that do not reach the ceiling. However, if machines are being used to roll and flush the angles, it is best to lift off the end of the tape already there and place the new tape under it. Thus you remove the possibility of the roller or flusher catching the end of the top tape and pulling it off.

When stringing tape on the ceiling, it may be easier to put the tape in place by holding one end and stringing an arm's length of tape, letting it hang between your hands. With a quick pull of the hand holding the loose tape you can snap the tape into position (Figure 4-11). Some tapers like to tape the butts and flats on the ceiling in this manner. The point to remember with this technique is that you must be very careful to centre the tape on the joint and snap the tape hard enough so that it will stick to the ceiling and not fall.

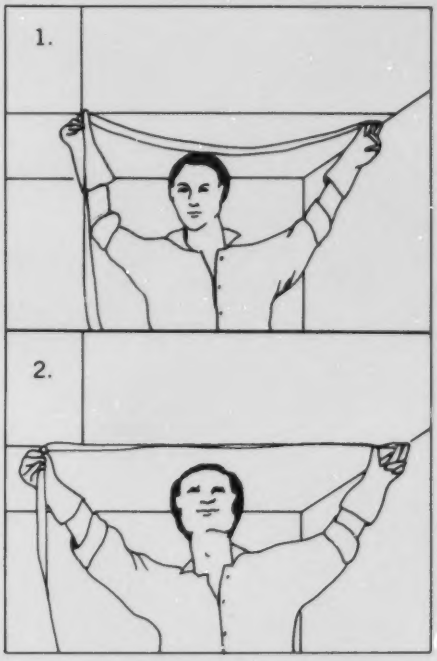


Figure 4-11
"Snapping" Tape from a Hopper in Place

As you move past the lightboxes on the ceiling, check them for excessively large openings and remember to short tape any that require it. If a joint runs through the middle of the lightbox it is best to run the tape right over the box. The tape can then be cut when the filler dries. If you cut the tape while it is still wet, you increase the risk of the tape peeling from the joint. Peeling usually occurs when the end of the tape extends over the edge of the opening 3 cm or more. Never wrap excess tape around the edge of the board into the electrical box. This is not appreciated by electricians and is the mark of an amateur taper. When taping the angles, cut the tape exactly the right length to reach the threeway but not extend beyond it. This takes practice and is important because it makes the wiper's job a lot easier. Also make sure the tape is tightly pressed into the angles.

Hopper Taping Sleuth Sheet

Problem	Cause	Solution
Tape is hard to pull.	Rear gate set too tight.	Set gate for 1 mm clearance.
Uneven thickness of mud on tape.	Tape not pulled down from hopper.	Use long pulls down and away from hopper.
Dry spots on tape.	1. Hopper getting empty. 2. Mud too thick. 3. Tape pulled up from hopper.	1. Refill. 2. Thin out mud. 3. Pull tape down.
Mud running out of hopper.	1. Gates set too far open. 2. Mud too thin.	1. Set gates 3 mm front 1 mm rear. 2. Thicken mud.
Tape breaks off in hopper.	1. End of roll. 2. Twisted tape. 3. Tape left in hopper has become moist.	Use wire bent in a loop and slide it through gates. Pull tape through loop and then pull wire and tape through hopper.

Banjo Method Hand Taping

A third method of hand taping is done with a device called a banjo (Figure 4-12). A banjo is smaller than a hopper, it holds less filler, and takes only one roll of tape. Wet tape is not pulled by hand from the banjo into a pail like with a hopper; rather the banjo is carried by the taper and the wet tape is applied directly to the wall from the banjo. The banjo is ideal for small jobs or one-man operations; it is a cleaner method of taping than the hopper since the tape and filler are carried in the banjo to the wallboard.

Loading and Filling the Banjo

Load tape on the dowel peg so that the tape rolls off from the top of the roll. Then feed the tape buffed edges up through the gate at the narrow end of the banjo. Fill the banjo with filler: some banjos have one compartment for both the tape and filler, whereas other banjos have separate compartments. Close the lid and the banjo is ready for use. Some banjos have a moveable gate for adjusting the amount of filler on the tape, but on other banjos the gate is fixed.

Applying Tape With A Banjo

1. Hold the banjo at an angle so that filler will accumulate at the gate. This will ensure a uniform layer of filler on the tape.
2. Pull out an arm's length of wet tape and press the tape onto the end of the joint.
3. Run the banjo along the joint, while pressing the tape into the joint with the trailing hand.

4. For taping vertical joints use the handle on top of the banjo; for horizontal joints use the handle mounted on the side.
5. Some banjos have a toothedge for tearing the tape but with others you will have to tear the tape against a knife.
6. Tape in the same sequence as with the hopper, dividing the room into a lower section and upper section.

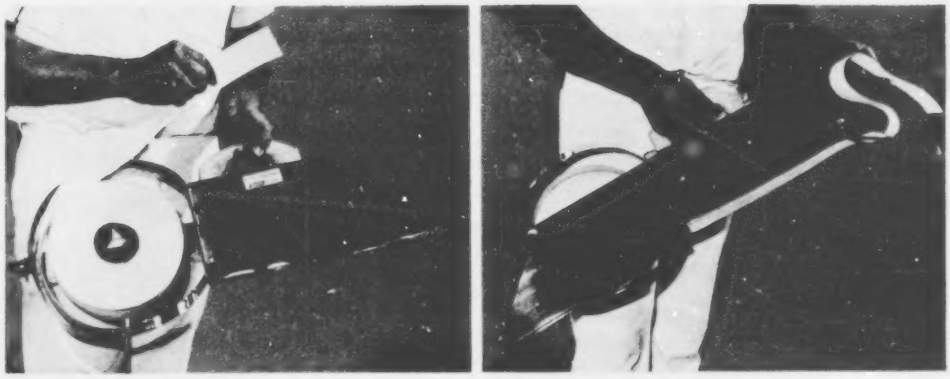


Figure 4-12
Banjo

EXERCISE

Hand Taping

1. What is the function of a drywall tape?
2. List five properties of paper tape.
3. Where can gauze tape be used?
4. In what sequence should angles, butts, flats, and short tapes be applied?
5. Why should you not press tapes into angles that are to be rounded?
6. State where the ends of tape should be in relation to·
   a. Ends of joints
   b. Beads
   c. Bottoms of angles
   d. Threeways
   e. Electrical outlets in joints
7. When would hand dry taping likely be used?
8. What is a quick way of telling if the consistency of the filler is right for taping?
9. How thick should filler for taping be spread on butts? Flats? Angles?
10. Which is the correct system for dry taping flats?
    a. Load filler in two or three flats, then lay the tape in.
    b. Load filler in one flat, then immediately lay the tape into the flat.

11. Name three uses for short tapes.
12. How many short tapes are required to tape around a pipe?
13. Short tapes must be placed around electrical outlets when there is a gap of more than ———— between the edge of the board and the box.
14. What must be done when dry taping angles to ensure a square angle?
15. True or False? When dry taping butt joints, the width of filler laid on the joint should be about twice the width of the tape?
16. What is the main advantage of the hopper method of taping over the dry taping method?
17. What is an advantage of a hopper over a tapping machine? A disadvantage?
18. True or False? An efficient way of hopper taping is to stack rolls of tape.
19. What is the purpose of the gate on a hopper?
20. When hopper taping, how do you crease tapes for angles?
21. How do you join two tapes on a vertical angle that will be rolled and flushed?
22. What causes tapes to peel off a ceiling before they are wiped?
23. What is the major difference between taping with a hopper and taping with a banjo?

Machine Taping

Machine Taping

The taping machine (Figure 4-13), also known as a bazooka, is the most commonly used method of taping in the industry. It is a highly productive machine when used by a skilled operator; for example, it is not uncommon for a good operator to put on two or more boxes of tape (upwards of 3 km of tape) in a 7.5 h day. The most common type of taping machine has drive wheels that operate a plunger mechanism which coats the tape with filler. It is this machine that is discussed here.

Figure 4-13
Taping Machine

The bazooka is most efficient with a three-man crew: one to operate the taper and two to wipe. This method of taping is most applicable to multiple units such as apartment blocks, condominiums, office blocks, high rises, where there is a great deal of wallboard to tape. Obviously production must be high to justify the cost of leasing or purchasing the taping machine and paying the salaries of three persons.

Besides high output, other advantages of a taping machine are: all taping can be done from the floor, and it is relatively clean because the only contact with filler occurs when applying short tapes. Disadvantages are: its cost of purchase or lease, it is awkward to use in some situations, e.g., closets, and it requires training time to use it proficiently.

Finishers must be careful to use correct body techniques with a taping machine. A loaded bazooka weighs 25 kg and handling it incorrectly can cause strain which can eventually lead to injury.

Tools

At least three pails are required with a bazooka — one for mixing the filler, one filled with water for the taping machine, and one for holding water for mixing. Additional pails are useful as they permit the mixing of several pails of filler at a time. A loading pump with a gooseneck attachment is required to fill the machine. A knife should be carried by the machine operator to cut paper and plastic out of the joints. A roller and flusher are needed by the wipers for the angles in order to keep up with the bazooka. Wipers also require a hand knife.

Loading Rolls of Tape

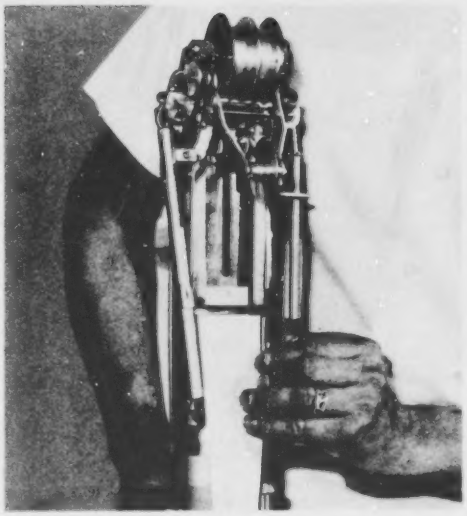
Only paper tape can be used with a taping machine and for best results it should not be wider than 5.5 cm. Before loading the tape, make these checks:

1. Pull down the collar to make sure the cutting blade moves freely.
2. Check the wheels to make sure they move freely.
3. Push the creasing wheel lever and release it to make sure the creasing wheel moves freely and that it returns to the normal position.

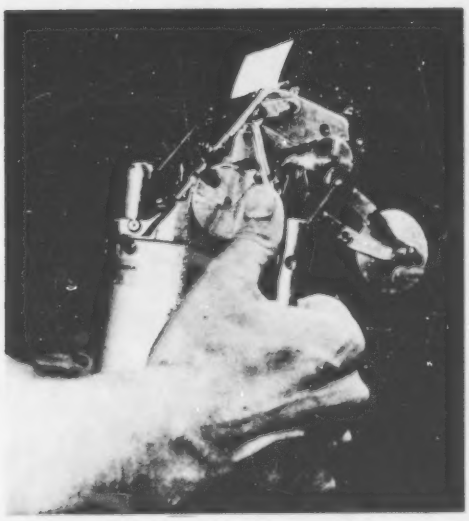
Follow these procedures to load a roll of tape:

1. Remove the retaining wire and place the tape on the holder so that the tape rolls from the bottom of the roll to the head of the machine (Figure 4-14). The reason for this is that when the tape is twisted to go into the head, the twist will be the right way so that it doesn't interfere with the hand on the collar.
2. Replace the wire and make sure the tape rolls freely. It must not, however, roll too freely, i.e., the tape should not continue to unroll after the machine stops. When this occurs push the centre of the tape so that the edge of the roll rubs slightly on the retaining wire slowing it down.
3. While putting on the roll of tape, check to make sure the little bottle of spare parts is still inside the tapeholder and is held in by the wire. The bottle contains replacement blades, cotter pins, springs, and needles. A little filler placed on the edge of the holder will keep the bottle in place.
4. Having put the roll in place, set the end of the bazooka on the floor so that the toe of your shoe catches the creasing wheel lever (to extend the wheel and get it out of the way) and one hand supports the machine on the collar. The collar should be in the neutral position.
5. With your free hand, pull the tape toward the head of the machine, giving it a quarter turn so that the buffed side is toward the machine. Slide it into the channel at the base of the head (Figure 4-14). Make sure that the tape runs over the top of the hand on the collar, and that the edges of the tape do not touch your skin. Paper tape can cause painful cuts.
6. Check that the channel is free of filler and that the tape moves freely through it.
7. Push the tape up the channel until it is 2 cm to 3 cm past the needle.
8. Lift up the collar to raise the needle, and feed the tape through and out of the head of the machine (Figure 4-14). The natural curl of the tape should come out over the drive wheels (Figure 4-14).

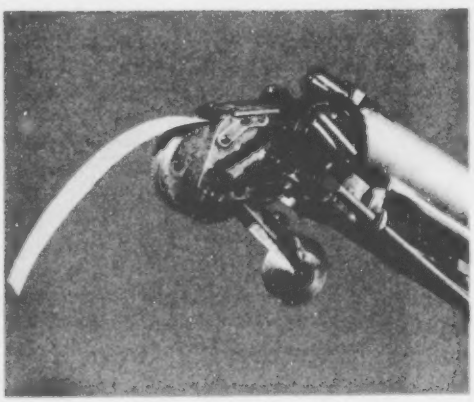
1. Put the roll onto the tape holder



2. Slide the tape into the channel



3. Feed the tape through



4. Natural roll of the tape is over the drive wheels

Figure 4-14
Loading Tape on a Taping Machine

9. When the tape appears over the drive wheels, pull down on the collar to cut the tape and check that the blade is making a clean cut. Rough, torn edges or jamming of the blade indicates that the blade is broken or dull and should be replaced. Several pieces of tape should be cut to make sure the blade is sharp and freely returns to the neutral position. Note that wet tape will not cut and will jam the blade, so pull enough tape through until the blade cuts dry tape.

Filling A Taping Machine

Consistency of Filler

Filler should be mixed fairly thin and smooth so that it can be poured from one pail to another. Filler for flats is usually thicker than filler for the angles. If the filler is too thin for the flats, the tape will slide along the joint and leave one end too short. Thin filler on flats can also cause the upper edge of the tape to peel off the wall when it is applied because the filler will not be thick enough to hold it in place. The filler is mixed thinner for angles so that the tape can be more easily creased to form a square corner. However, the filler can be too thin and the sign that this is the case is that filler will run down the wall when the angle is flushed.

The Loading Pump

Place the round tube of the pump in a pail of filler. The side of the pail should slide between the round tube and the foot plate. The pump can then be slightly turned and the pail wedged tightly in place by stepping on the foot pad. This ensures that the pump will not wobble when the taping machine is being filled.

Use the pump without a screen when filling the taping machine. The reason for this is that if the screen plugs the pump has to be pulled out of the filler and the screen cleaned. This is a messy and time-consuming procedure. The machine operator is usually supposed to keep two co-workers busy. Stopping for any length of time means that they will be idle and thus the cost in wages of cleaning the screen is tripled. Mix the filler so that there are no lumps. However, even if a few lumps pass into the machine (since there is no screen), they shouldn't cause any problems.

To prevent air bubbles from getting into the bazooka, the pump should not be removed from the pail. If additional filler is required it should be poured into the pail. Air bubbles are a major problem in that if seen they slow down the wiper's work, and if not seen they create defects in the finished work.

Pump the filler until it is visible at the end of the gooseneck. This also prevents air from being pumped into the bazooka. If the pump is new or was thoroughly washed out after the last use, you may have trouble getting it to pump. Short, fast strokes on the handle should get it going; if not, remove the pump from the filler pail and place it in a pail of water, again giving the handle short, fast strokes. If it still does not work, turn it upside down and pour water into it or pour water into the exit port and pump the handle. This should get the plunger wet and create the necessary suction to pump the filler. However, if all this fails, a part is probably worn out and you should return the pump to the manufacturer or the distributor for service.

Filling Procedures

1. The small hook-shaped lever on the right side of the head of the bazooka operates the flap that lets filler out onto the tape. During taping, the flap lever must be up and the flap open; during filling the lever must be down and the flap closed. The flap lever strikes against a flat pulley when it is pushed down. This pulley must be pushed in before the lever can be set in its down position. The pully is connected to a shaft; this shaft engages and disengages a drive mechanism that turns the drum, winds the cable, and pulls up the plunger when the bazooka is operated. During taping, the pulley must be pulled out; during filling it must be pushed in.

   Prior to filling the bazooka:

   a. Push the flap lever down until it strikes the pulley.

   b. As the lever strikes the pulley, push the pulley in with the thumb of your other hand and continue pushing the lever until it reaches the down position. Note that the lever must be completely down so that the flap is tightly closed and thus no filler will flow out the head of the machine. Also note that the pulley must be pushed in to disengage the drive mechanism allowing the drum, cable, and plunger, to roll freely as the bazooka tube fills.

2. Locate the filling nozzle on the flat plate on the bazooka head. This nozzle contains a spring loaded valve that allows filler to flow in but not out.
3. Insert the nozzle into the opening at the end of the gooseneck of the pump.
4. Lay the bazooka into the cradle of the gooseneck. It should stand by itself with the wheels facing away from the pail.
5. Place your left foot on the foot pad and your left hand at the open end of the bazooka to feel the plunger when it reaches the top. Take care to keep your fingers in the middle of the tube, not resting on the side. The plunger can easily run over your fingers because of the strong hydraulic pressure acting on it. This is very painful and if it does happen and you are unable to reach the valve that releases the pressure, call for help.
6. Pump filler into the bazooka. It should take nine to eleven pumps of the handle to fill it. Remember this because any more means there is likely a leak somewhere and air is getting into the bazooka.
7. As soon as you feel the plunger reaching the top, stop pumping; too much pressure will force the plunger out the end.
8. Remove the machine from the cradle and hold the head so that it points into the pail.
9. Lift up the lever that operates the flap to the taping position. This will cause a bit of filler to squirt out of the head from the pressure in the tube. Wipe the excess filler from the tape on the edge of the pail.
10. The bazooka is now ready for use.

Problems When Filling A Taping Machine

Sometimes filler will run out of the valve as you pick up the machine. This means that something has jammed the valve open. If it is left jammed while the tape is run onto the wall, the filler will run out the valve and reduce the amount going onto the tape, as well as make a mess. By poking inside the nozzle with a nail or a rigid piece of wire, you can

usually free the valve. Do not use plastic-coated electrical wire since a piece of the coating could be cut off and itself get caught in the end of the valve. If after this attempt, the valve still remains stuck, you may have to remove it for cleaning.

You can remove the valve by first loosening the set screw that locks the valve in place in the head and then by tapping a screwdriver against the screw on the valve. If this does not budge the valve you can use a pair of pliers but make sure to place the pliers at the bottom of the valve. Twist the valve with the pliers to pull it out. Be very careful not to bend or otherwise disfigure the valve. Wash the valve in water and remove the material jamming it. Check that the spring has enough tension to form a tight seal. In replacing the valve, make sure it sits squarely in the hole. You may have to tap it a bit to press it back into the hole but do not tap the end of the valve with a hard material. Instead use a piece of wood or similar soft material to avoid damage that would prevent the nozzle from fitting tightly into the gooseneck.

Sometimes filler will not pass through the valve into the bazooka even though the valve appears to be clean. This may be caused by dried filler trapped in the spring preventing the valve from opening completely. To correct this problem, remove the valve and tap the spring to dislodge the dry filler, then work the spring until the valve freely opens and closes. In the future, make sure to wash the valve thoroughly to prevent a recurrence of the problem.

Another problem that can arise when filling a bazooka is that on well used machines the cutter blade chain becomes slack and can jam the winding key. If pressure is then applied by the pump, it is possible to break the cable. Check for a slack chain and if necessary have it replaced.

Rinsing the Machine Head

Whenever the machine is stopped for five minutes or more, place the head in a pail of water to prevent filler from drying and jamming the moving parts. Even when the machine is in use, periodic dousing of the head in water is a good idea. Before immersing the head (Note: these steps aren't required for a quick rinse):

1. Remove the tape from the head because it gets soft when wet and will tear when the needle tries to pull it through. Wet, soggy tape will jam the cutting blade.
2. Close the flap that holds filler in the tube. (Also close this flap whenever setting down the machine head first.) The closed flap will prevent filler leaking out and thus the plunger from sliding down the tube without the cable winding up. If this should occur the slack cable could become tangled and break when the machine is filled again.

Taping Sequence for Machines

The best sequence for machine taping a room is usually: butts on the ceiling, butts on the walls, flats on the ceiling, flats on the walls, short tapes, and angles. The reasons for doing all the butts in the room first, then all the flats rather than doing the butts and flats on the ceiling, then the butts and flats on each wall are:

1. The wipper will not have to wipe interesecting butt and flat tapes where both tapes are unwiped.
2. The taper and wiper will stay out of each other's way.

A recommended sequence for applying angle tapes with a machine is as follows:

1. Start at the first vertical angle closest to the door as you walk in the room.
2. Tape the vertical angle.
3. Tape the horizontal angle to the right.
4. And so on, the vertical angle, then the horizontal angle to the right until you return to the vertical angle you started at. Note that taping to the right is recommended because most taping machines are designed to work best to the right.

Procedures With A Newly Filled Bazooka

1. Each time a bazooka is newly filled:
   a. Give the winding key on the left side of the head a turn or two to bring the plunger up tight against the filler in the tube and feed filler onto the tape. This will decrease the chance of dry spots at the beginning of a tape.
   b. Run a horizontal wall flat (it need be no more than 1 m) that does not interfere with butt joints; or on the off chance that there isn't such a flat in the room run an upper wall butt joint or a vertical flat. This procedure eliminates dry spots or air pockets under the tape by ensuring that the plunger cable is brought up tight against the filler and does not slide back as it would in the upright position if you did a ceiling flat first.

Basic Procedures For Machine Taping Joints

1. To begin taping, put both wheels of the machine on the wallboard at the beginning of the joint or angle. To start with a section of tape is pre-run, then lifted from the wallboard and set in place. Pre-running is necessary so that you can start the tape exactly where you want it.
2. Roll the wheels forward, simultaneously pushing the collar forward to advance the tape. Thus the tape and filler will feed together. Don't worry about marks left by the wheels as they will be covered when the joint is coated.
3. For upper butts pre-run approximately 15 cm of tape then holding the tape firm with the hand on the collar lift the 15 cm of tape off the joint. For flats and horizontal angles pre-run approximately 8 cm. And for lower butts and vertical angles pre-run enough tape (starting at a comfortable height usually about 60 cm from the floor) so that when you lift the tape from the wall it will reach the bottom of the joint without you having to bend your back (Figure 4-15). The object here is to put the least strain possible on the back.
4. Set the pre-run tape in place using the creasing wheel as a guide at the start of the joint (Figure 4-16). Some overhang is necessary to compensate for dragging of the tape when the joint is run. For butts and vertical angles leave an overhang of 3 cm; for flats and horizontal angles leave 6 cm. If you over compensate the wiper will cut the tape to the right length. You are now ready to run the joint.
5. Before starting to run flats and horizontal angles make sure the drive wheels are right against the angle. On lower butts and vertical angles the drive wheels should be no closer than 3 cm to the floor.
6. With both wheels on the wallboard start to run the machine, snapping the creasing wheel against the tape as soon as possible after starting off.

Figure 4-15
Pre-run and Place
Tape for Vertical Angle

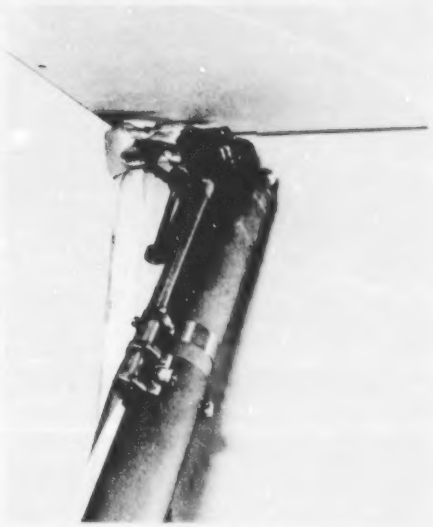


Figure 4-16
Setting Tape in Place with
the Creasing Wheel

Figure 4-17
One Wheel Lifted from
the Wallboard

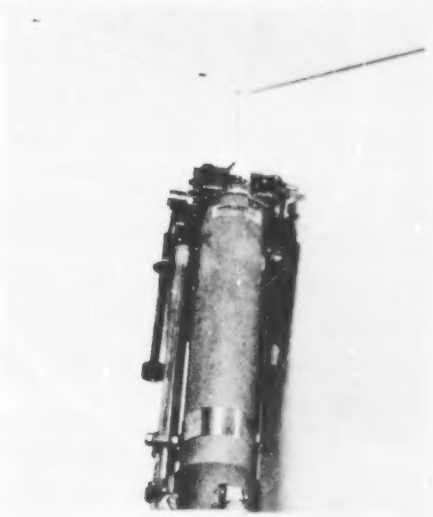


Figure 4-18
Taping Machine
Bisects Angles

7. After about 15 cm, drop the back of the machine and rotate it so that only one wheel touches the wallboard (Figure 4-17). This will leave filler under the full width of the tape. If both wheels are placed on the wallboard, filler will be squeezed from under the tape and drip to the floor. Note that running with one wheel on the wallboard only applies to flats and butts. For angles, both wheels touch the wallboard, one on each side of the angle.
8. Run the lenfth of the joint, on butts and flats keeping the drivewheel parallel to the joint, and on angles holding the machine so that it bisects the angle (Figure 4-18). On horizontal joints and angles the head of the machine should be approximately 30 cm ahead of your body so that you push rather than pull.

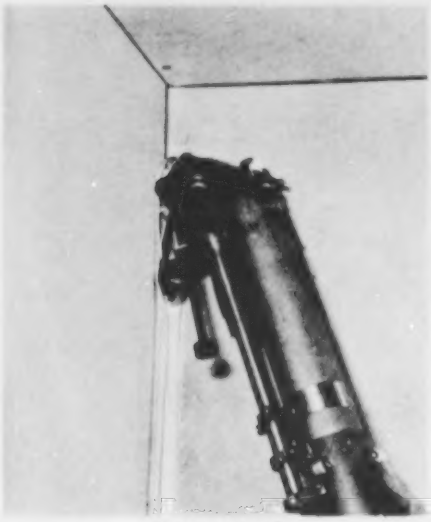


Figure 4-19
Position for Cutting the Tape

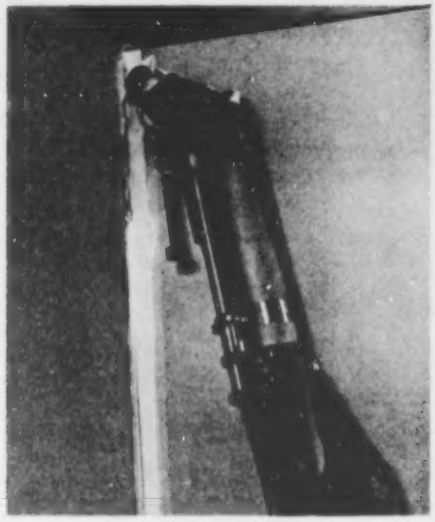


Figure 4-20
Set the Angle Tape End into Place with the Creasing Wheel

9. As you approach the end of the joint prepare to cut the tape. Keep in mind that there are 6 cm of tape beyond the drive wheels to the point where the tape is cut. With experience you will know exactly where to cut the tape, but here is a rule of thumb to follow while you are learning to use the machine: line up the end of the filler valve with the end of the joint (Figure 4-19). At this point stop the machine (the machine must always be stopped for cutting), pull back the collar to cut the tape, and release the creasing wheel (Figure 4-20).
10. Pull the machine back a bit then ahead to the end of the joint, simultaneously pushing the collar forward to advance the tape. The tape should be completely coated with filler in preparation for the next joint.
11. As you remove the machine from the joint, snap the creasing wheel onto the cut end of the tape to set it in place. Release the creasing wheel.

Note that the basic taping machine procedures are given here. With experience you will develop your own style from these basics.

Jammed Blades

Problems can result if you try to cut a tape while the tape is moving. If you are lucky the only thing that will happen is that the tape will be cut on an angle. If you are not so lucky the blade will jam or even break. When the blade jams, the needle that moves the tape forward will tear the tape.

To free a jammed blade, place the machine on the floor so that the toe of your shoe catches the creasing-wheel lever and gets the creasing-wheel out of the way. Push up the collar so that the needle is at the top of its travel and out of the way. Note that this may bunch up the tape in the channel as the needle will pull up more tape. Do the following until the blade is free:

1. Pull the tape out of the channel making sure no tape remains in the grooves. You will hear a snap as you pull out the tape if the blade is freed. If the blade is still jammed try point 2.
2. Rinse the head in a pail of water to clean off any filler that may be blocking the channel. Pull back on the collar and see if the collar i.e., the blade, returns to the free position. If not, try point 3.
3. Pull the cutter chain and let it snap back. If the blade is still not free try point 4.
4. Make a little tool from a piece of corner bead to fish out the tape that is blocking the passage at the end of the channel. Cut the corner bead 1.5 cm wide and 8 to 10 cm long. Round off the corners at one end and cut out a V-section on one side to make a hook (Figure 4-21). Pull the cutter chain as far as possible towards the side on which the chain connects the collar so that it is not blocking the channel. Slide the hook through the channel into the passage and pull out the paper blocking the passage. If may take a few tries to get it.

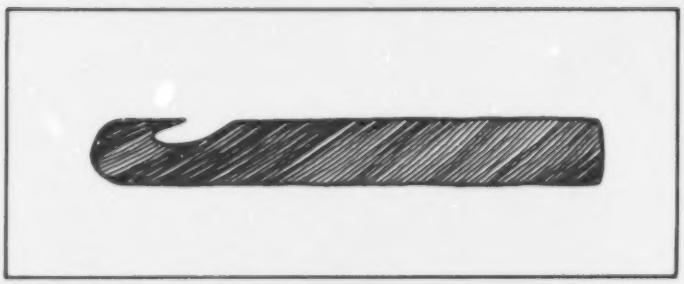


Figure 4-21
Tape Hook Made from Corner Bead

After the blade is free feed the tape back into the machine and push it forward with the collar. Once the tape is showing at the front of the head make a cut to check for a broken or damaged blade.

Beware of a problem that can result from freeing jammed blades. As tape is pulled back through the head to release the jam, filler gets caught in the channel. The trapped filler can mount up over several jammed blades. When taping resumes, this filler becomes dry from the friction of the tape moving through the channel. To get it out, the head has to be soaked and the channel scrubbed with a brush.

Short Tapes With Machines

Short tapes can be applied two ways: direct from the machine, or cut from the machine and put in place by hand. Putting them in place by machine is probably faster and cleaner, but hand application is more accurate. To apply short tapes by hand, turn the winding key on the left so that filler and tape are pushed out. Remember when 3 cm of tape shows, 9 cm will be the cut length of tape. It takes practice to cut tapes the right length; the wiper will let you know soon enough when you are wrong. Short tapes around pipes should be left for the wiper to place so that they have a tight fit.

An alternative to cutting short tapes with the machine is to run off the length of tape required, then rip the tape against the plate above the wheels (Figure 4-22). The length of tape will be accurate but the cut will probably be rough.

Figure 4-22
Ripping Tape from the Machine

Taping Machine Holding Positions

Taping machines should be held so that the right hand holds the collar. Many people mistakenly believe that a taping machine can be used with either hand on the collar. You can get away with the left hand on the collar for the butts and flats, but you'll run into trouble with the angles. When the left hand is on the collar, the winding key is next to the wall. If you hold the machine at the proper 45° angle for taping angles, the key will contact the wall and besides gouging the paper it will hinder the winding of the plunger causing dry spots underneath the tape. If you try to compensate by changing the angle of the machine, this will cause the tape to drag along the angle and possibly fall off.

Put enough pressure on the head of the machine to keep the drive wheel or wheels touching the wallboard so that they do not skip. The wheels set in motion the mechanisms that feed filler onto the tape; the wheels do not feed the tape. Thus when they are lifted from the wall the tape is still pulled out of the machine leaving a dry

spot on the tape. Pressure should always be applied by the left hand on the end of the machine, not by the right hand on the collar.

Following are holding positions for the various joints:

1. **Lower butts.** Push down with your left hand and with the right hand acting as a fulcrum bring the head of the machine up the joint.
2. **Wall flats.** To run a flat turn your body so that you can walk forward. Push the machine with it contacting the joint about 30 cm in front of your body at an angle between 45° and 60° to the wall (Figure 4-23). Check your path for obstacles.

   To apply pressure, pull the bottom end of the machine away from the wall with your left hand while your right hand acts as a fulcrum. By locking your right arm in close to your right hip, it should support the weight of the machine. In addition to applying pressure, your left hand also regulates the angle of the machine to the wall.

Figure 4-23
Taping a Flat

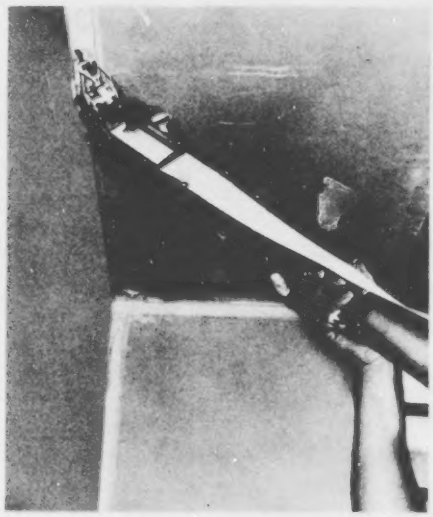


Figure 4-24
Taping a Horizontal Angle

3. **Vertical angles.** Here is a check to see if you have the correct holding position when taping a vertical angle: once the head is pointing toward the ceiling you should be able to remove your right hand. The machine should stay in the angle with only your left hand pushing it. This demonstrates the fact that your right hand is only a support, and should not be used to apply pressure on the head.
4. **Ceiling flats and butts.** The machine should contact the ceiling about 30 cm ahead of your body like with wall flats. Your right arm acts as a guide while your left arm applies pressure. To minimize strain on your body joints, distribute the weight over your body by keeping your right arm as straight as possible or by locking it into a comfortable position. The head of the machine should be to the right of your right shoulder for two reasons: loose filler will not fall on you, and in this

position you create an angle between yourself and the joint that permits one wheel of the machine to lift off the board.

5. **Horizontal angles.** When properly held, the weight of the machine should fall on your left arm. Your right arm should only guide the machine and cut the tape and definitely should not bear weight or pull the machine along the angle. For the machine to be in the correct position two factors must be right. First, the machine head should not be too far in front of you, and second the butt end of the machine should be held high enough so that the machine approximately bisects the angle (Figure 4-24). To test if the machine is in the correct position remove your right hand. If the machine continues to move along the angle with only your left hand applying pressure, the position is right. However, if the machine falls away from the angle, the machine is too far in front of you, the butt end is too low, or both.

Keypoints With Taping Machines

1. The horizontal angles between the wall and ceiling are the most difficult to tape. The key to keeping the tapes straight and on the angle is to hold the machine so that it bisects the angle; otherwise one wheel will run the tape to the side of the angle, resulting in the tape dragging along the angle until it falls off. When a tape goes off-centre extra effort must be exerted to keep it in the angle by applying pressure with the right hand. However, this only accentuates the problem because the more pressure you apply with your right hand the less you apply with your left hand. With this grip the end of the machine will twist, causing the head of the machine to jump from side to side in the angle.
2. Take extra care when cutting tapes at threeways. There is little tolerance as you must put tapes tight into the threeways so that they form square angles when wiped.
3. It is important to make sure that the ends of the tape on flats and butts are firmly pressed to the board with the creasing wheel. If this is not done the ends will start to peel off and, if not caught, the whole tape will fall off.
4. As with the hopper method of taping, run the tape right across any light boxes occurring along a ceiling joint.
5. Be careful at the end of a roll of tape that you do not run the staples that hold the tape to the cardboard centre through the machine. They may get caught in the channel and time will be lost getting them out.
6. You can tell when a bazooka is running low on filler by a whooshing sound. When you hear it, prepare for the tape to be dry in about another 60 cm. A full bazooka will tape about 25 metres.
7. Do not drop the bottom end of the machine on the floor when it is still more than half full, since the plunger will have a great deal of weight on it from the remaining filler and the sudden jar may break the cable. Replacing the cable is a time-consuming procedure.

Machine Taping Closets

Closets give rise to special taping problems. Usually closets are not deep enough to enable you to tape the front angles in the normal way. The front vertical angles have to be taped by stripping the tape off the machine and putting it into the bottom of the angle by hand. Set the machine on the floor so that the head of it points toward the

ceiling. Unwind about 3 cm of tape and filler from the machine and then pull the tape down to the floor with your left hand. Use the index and second fingers of your right hand to form a brake as the tape slides through them. Also put pressure on and turn the wheels with your right hand so that filler is applied to the tape. Pull out enough tape so that the machine can be pushed up the vertical angle.

The horizontal angle at the front of the closet also cannot be taped normally because you cannot angle the machine enough to get one of the wheels on the wall. Only the wheel closest to the ceiling will touch. Leaving adequate overhang to account for the increased drag, put the tape into the threeway and pull the machine along the angle. Snap the creasing wheel into the angle as far as it will go, but note that because of the angle at which the machine is being run, the tape will not have much of a crease. The wheel just makes sure that the tape stays up. To move the machine, lean back and use your arms to push and pull it above your body. You will not be able to cut the tape the right length, so allow enough room at the end of the angle to run it out of the machine and make the cut. After cutting the tape use the creasing wheel to push the tape into the angle so it doesn't fall off. Leave to the wiper the task of getting the tape centred in the angle.

Machine Taping Valances

Taping the angle under a valance makes the job look more complete, and is an added touch that shows your concern for doing a good job. Most valances are too narrow to allow the machine to fit in the proper way because of the cutter-chain mechanism on the right side. For this reason, the machine is usually run with your left hand on the collar from right to left. This direction works with valances because the window opening allows the winding key to turn freely. Be careful to avoid letting your right hand come in contact with the edge of the tape as it runs through the machine; the tape is twisted at such an angle that it can easily cut your skin. Strip at least 60 cm of tape from the machine and place it in the angle so that the butt end of the machine can be lifted as high as possible. Leave at least 15 cm of tape overhanging in the threeway to compensate for drag. Lift your right hand high to get the wheels running as parallel as possible to the angle and to minimize dragging of the tape. Snap the wheel into the angle as soon as possible to get the tape to stick to the angle; all that is needed here is for the crease of the tape to be close to the centre of the angle so that it can be put in place by the wiper.

Taping closets and valances takes practice, so don't expect to be successful the first time. Also note that you can develop your own variations on the basics described here to do these angles.

Cleaning A Taping Machine

If filler is left in the machine after taping is finished, push in the flat pulley on the right side and crank the wheel on the left. This disengages the drive wheel mechanism in the head while allowing the plunger cable to wind on the drum as the filler is pushed out. During cleanup keep the gate valve lever in the up position to prevent any water from entering the tube and causing the plunger to move and unwind the cable. Remove the tape from the machine to prevent it from getting wet. Wash the outside of the machine with a brush making sure the entire machine is clean. The head must be especially clean, since any filler left to dry will prevent the machine from operating smoothly. Using a hose, force water through the filler valve until the escaping water is clean again

making sure the gate valve lever is up so that the water is forced out over the wheels, not up into the tube. Force water up into the point just above the wheels where the tape comes out; this cleans filler from the cable. Also force water through the holes in the drive wheel drum.

If a hose is not available, use the pump to clean the machine. After thoroughly cleaning the pump, put the whole pump into a clean pail of water so that water coming out of the gooseneck stays in the pail. Place the machine on the gooseneck with the wheels facing the pump, and pump the water through the valve out over the wheels. Make sure the gate valve lever is in the up position so that water does not enter the machine.

After cleaning, give a light oiling to the drive wheels, chains, filler valve, and the channel for the cutting blade. The machine should then be left standing with the head to the floor so that any excess oil drains off. Do not oil a machine if it is to be used soon after, since the oil could be transferred to the wall and prevent proper adhesion of the filler. No parts should be under tension when the machine is left standing: the flap lever should be up and the collar in neutral.

A good cleaning job requires at least ten minutes. The cleaning should be done by the operator, the only person who really cares about keeping the machine in good operating condition.

Bazooka Courtesies

Because it is very easy for tapers to get ahead of wipers, certain rules of etiquette should be followed to maintain harmony between the two. Remember taping is team work: the better the team work the greater the production.

1. If a dry tape is left at the end of a joint, let the wiper know that the tape is dry and peel the tape back to where the filler stopped. Avoid leaving dry tapes longer than 30 cm.
2. Concentrate on cutting the tapes the right length. If they are long or short, the wiper will have extra work and get behind.
3. If two tapes are put on the same joint, let the wiper know so that the method of wiping can be adjusted accordingly. If two tapes occur along a vertical angle overlap the higher tape and bring this to the wiper's attention.
4. If a joint occurs in an unusual place, bring it to the wiper's attention.
5. If more than two tapes are used in one place, as in the case of electrical outlets or in covering a hole, have the wiper wipe them as you apply them.
6. If plastic is found in an angle, have the wiper cut it out, since it is easier to cut out the plastic when it is not covered with filler.
7. Check with the wiper to make sure the filler is not too thick or too thin.
8. Make sure the wheels do not skip and leave a dry spot under the tape on ceiling joints because they are very difficult to reach from the floor.
9. Place something under the end of the pump gooseneck to catch any filler that runs out when loading the bazooka.
10. Put the pail and pump where they will not hinder you or anyone else's movement, i.e., away from the walls, the doorway, and not under ceiling joints.
11. Keep the machine clean at all times.

Module 4

Machine Taping Sleuth Sheet

Problem	Cause	Solution
Filler will not go into automatic taper.	1. No filler at pump.	1. Fill pail with filler or scrape filler toward entry port on pump.
	2. Pump not primed.	2. a. Put pump in water and use short strokes on handle until water pumps through. b. Pour water down exit port then pump handle.
	3. Entry port of pump plugged.	3. Remove pump and clean entry port; remove screen if present but do not replace. Re-mix filler.
	4. Dried filler at exit port of pump.	4. Soak exit port to soften filler and clean.
	5. Spring in filler valve plugged.	5. Remove valve, soak in water, then clean spring thoroughly.
	6. Flap lever on automatic taper not in fill position.	6. Push flap lever to fill position.
	7. Plunger mechanism jammed.	7. Take machine apart and unjam. Check cutter chain for binding with winder key. Check cable to make sure it was properly wound.
	8. Automatic taper is full.	
Filler valve leaks.	1. Something stuck between valve and seat.	1. Use nail to tap on valve to dislodge foreign material. 2. Remove filler valve and clean.
Filler does not flow onto tape.	1. Flap lever not open.	1. Pull flap lever all the way up.
	2. Cable broken.	2. Push plunger from end of machine and replace cable.
	3. Dirty head.	3. Soak head and remove solidified filler.
	4 Drive wheels not turning.	4. a. Make sure drive wheels are contacting board. b. Remove dry filler that may be binding wheels, by soaking machine head in water.

Machine Taping Sleuth Sheet

Problem	Cause	Solution
		c. Check drive chain for breakage. d. Check tension on drive chain. If too loose, tighten with chain-tightening guide or replace.
	5. Drive chain broken.	5. Replace chain.
	6. Clutch actuator piston has not returned to working position.	6. Push piston back.
Tape drags along joint.	1. Mud too thick.	1. Thin mud to proper consistency.
	2. Too much pressure on drive wheels.	2. Relax more, exerting only enough pressure to make wheels turn.
	3. Tape not properly started.	3. Both wheels should touch wall for first 15 cm of joint.
	4. Head of machine not parallel to joint.	4. Turn head so that drive wheels are parallel to joint.
	5. Tape not feeding through machine freely.	5. Clean tracks and soak head. Check for tape binding around roll.
	6. Creaser wheel pressing too hard.	6. Relax pressure on creaser-wheel lever.
Tapes falling off joints.	1. Tapes dragging along joint.	1. See solutions above.
	2. Mud too thin.	2. Thicken mud.
	3. Ends of tape not pressed against wall.	3. Press ends of tape against board.
	4. Tape cut at electrical outlets.	4. Run tape over outlets.
Tapes too long.	1. Not cut soon enough.	1. Sight along the filler valve to the end of the joint, then cut.
	2. Collar not pulled back far enough.	2. Collar should be pulled all the way back in cutting position.

Module 4

Machine Taping Sleuth Sheet

Problem	Cause	Solution
Tapes too short.	1. Tape dragging.	1. See "tape drags along the joint."
	2. Tape cut too soon.	2. Sight along the filler valve to the end of the joint, then cut.
	3. Lack of overhang when joint started.	3. Overhang should be left when starting any joint.
Drive wheels won't turn.	1. Dry filler in head.	1. Soak machine head in water and wash off excess filler.
	2. Drive chain stiff or jammed.	2. a. Oil drive chain and drive wheels after every shift. b. Check tightness of chain and adjust. c. Check for blade rod jamming chain.
Tape won't cut.	1. Blade broken. 2. Blade jammed.	1. Replace blade. 2. Clean track.
Tape won't cut square.	1. Machine not stopped when tape cut.	1. Stop machine before cutting tape.
Tape won't easily pass through head.	1. Tape feed-needle catching tape.	1. Set tape-feed needle so that it is clear of tape when collar is pushed forward.
	2. Dry filler in tape-feeding system.	2. Soak head of machine in water and clean tracks.
Tape won't pass through head at all.	1. Blade jammed in track.	1. Pull blade to one side and let it snap back.
	2. Piece of paper caught in track.	2. Use hook to pull paper out of track.

Machine Taping Sleuth Sheet

Problem	Cause	Solution
Tape cannot be advanced with collar.	1. Tape jammed in head, causing needle to tear tape. 2. Advancing needle not deep enough. 3. Advancing needle not touching tape when collar in neutral position.	1. Use hook to pull out jammed paper. 2. Set needle with collar in neutral position so that needle penetrates tape by 1 mm. 3. Set rail on right side of head so that needle is pushed down into tape when collar in neutral.
Dry tape.	1. Automatic taper empty. 2. Drive wheels not touching. 3. Cable broken. 4. Plunger safety not engaged. 5. Flap lever still contacting clutch disk.	1. Refill. 2. Maintain steady pressure on drive wheels. 3. Tear down machine and replace cable. 4. Push rod back into machine. 5. Lift gate valve all the way up.

EXERCISE

1. What are the advantages of a taping machine over a hopper?
2. What are the disadvantages of taping machines?
3. List the tools required for machine taping and wiping.
4. Why should the loading pump be used without a screen?
5. What are two ways to prevent air from getting pumped into the machine?
6. Why should the head of the taping machine be soaked in water before use?
7. How should the tape come off the roll when properly loaded on the machine?
8. What do rough torn edges on a cut tape or jamming of the blade indicate when the tape is cut?
9. What are two reasons that the flap lever must be pushed all the way down when filling the machine?
10. How many pumps of the handle should it take to fill a taping machine?
11. The filling nozzle valve can jam. How do you free a jammed valve?
12. What is the sequence for applying tapes by machine?
13. How can you avoid air pockets under the tape when using a taping machine that has just been filled?

14. If a loaded bazooka is not to be used for ten minutes, what should be done with it?
15. Why is it necessary to pre-run a section of tape when starting an angle or joint?
16. Should both wheels contact the wall when taping flats or butts?
17. What is the purpose of overhanging tape at the beginning of a joint?
18. How much tape will come out of the machine after it has been cut?
19. How can you tell if you have not stopped the machine to cut the tape?
20. After cutting the tape how do you prepare the tape for the next joint?
21. Why is a taping machine considered a right-handled tool?
22. Why is it essential to keep the drive wheel(s) in contact with the wallboard?
23. Which hand applies the pressure to keep the wheels on the wall?
24. When a taping machine is properly held for a wall flat, what will the angle be between the machine and the wall?
25. What is the test for checking that the machine is held in the correct position for horizontal angles?
26. What is the key to keeping horizontal angle tapes straight and on the angle?
27. The ends of the tape must be firmly pressed to the board with the _____ otherwise they will _____ .
28. When should the head of the taping machine be oiled?
29. Why are the bazooka courtesies listed in this module the key to greater production when using the taping machine?

Wiping Tapes

Wiping Tapes

A basic and very important part of drywall finishing is wiping tapes. Wiping forces filler through the perforations and fibres of the paper tape to provide a good bond and at the same time removes excess filler leaving a smooth, edge-free surface. These processes are called imbedding the tape and feathering the edges. During wiping a thin coat of filler is left on the tape to seal the edges to the surface of the board. After wiping, tapes must be smooth and flat, otherwise they will show up in the finished product as cracks, ripples, or bumps. Wiping procedures for tapes are the same whether the tapes have been applied by hand or by machine.

Hand Wiping Tools

A fairly wide knife (at least 17 cm) with a long handle is a basic tool for wiping tapes on flats and butts. The width enables wiping a good length of tape before having to stop to clean off the knife and the long handle enables a person of average height to wipe tapes up to the 2400 mm mark (Figure 4-25), standard ceiling height. A short handled knife can be used for wiping tapes applied by hand. A pan rather than a hawk is recommended for holding filler wiped from tapes because the consistency of the filler used in taping is generally thinner than can be easily held on a hawk.

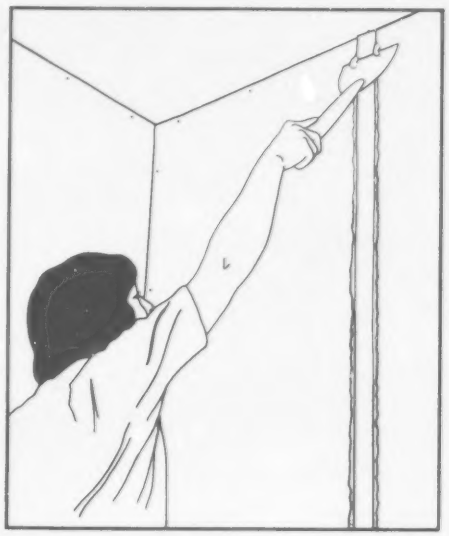


Figure 4-25
Long Handled Knife

In addition to the wide knife for wiping flats and butts, you should also have a 12 cm knife for angles and for tapes 30 cm or less, and a 10 cm knife for narrow places such as under valances or beside pipes and window sills. A special angle knife may be required for wiping angles less than 90°. it is also a good practice to carry tape with you because some areas that are left untaped may be too small to warrant calling the taper back.

Tools are available to simplify the wiping of angles, and they can be used with any method of taping. One tool called a roller (Figure 4-34) embeds the tape and the other tool, a flusher (Figure 4-35), removes the excess filler and feathers the edges. These tools speed up wiping and produce a uniform job that is pleasing to the eye. As with any tool, the quality of the job will depend upon the skill of the operator.

Angle tools are designed for square angles, even surfaces, and properly applied wallboard; but they will adjust to minor imperfections.

Note that an angle can be rolled and then can be wiped either with a flusher or with a knife.

General Points On Wiping

1. Butts, flats and short tapes are wiped with a knife. Angles are wiped with a knife or with a combination of two angle tools called a roller and a flusher.
2. Starting at a point between the two ends of tape, all tapes that are hand wiped must be wiped in two directions to eliminate the problem of the tape wrinkling. Procedures for hand wiping butts, flats, and angles are given in this module.
3. The amount of pressure applied to the knife and the angle of the knife to the wallboard regulate the amount of pressure applied by the knife and thus the amount of filler removed. The angle of the knife will vary with its flexibility, but generally it should be close to 45° (Figure 4-26). The closer the angle is to 90° the more filler is removed from under the tape and the more chance there is of the tape dragging along the joint. The angle of the knife also regulates how much filler is left covering the top of the tape. As a knife is pulled along a tape:
   a. The tape is imbedded.
   b. Filler flows under the tape to fill in any dry spots.
   c. Excess filler is trapped between the knife and the wall. Some of it escapes between the blade and the wall, coating the tape and leaving feathered edges.

   All of these processes are desirable to produce a properly wiped tape.
4. When starting to wipe a new tape you will need a bit of filler on the knife to start the skim coat on top of the tape.
5. The right amount of filler must be left under the tape. Too much filler under the tape will leave the tape too close to the top of the bevel and cause the tape to show after the joint has been finished and sanded. Conversely, too little filler under the tape will leave dry spots that cause the tape to lift off the wall when the joint is filled. To get the right amount make sure the knife blade is filed square and the blade is held close to a 45° angle.
6. Too much filler must not be left on top of the tape because it will cause excessive shrinkage. This shrinkage is difficult to cover and can also cause cracks on the edges owing to shrinkage of the filler around the tape.

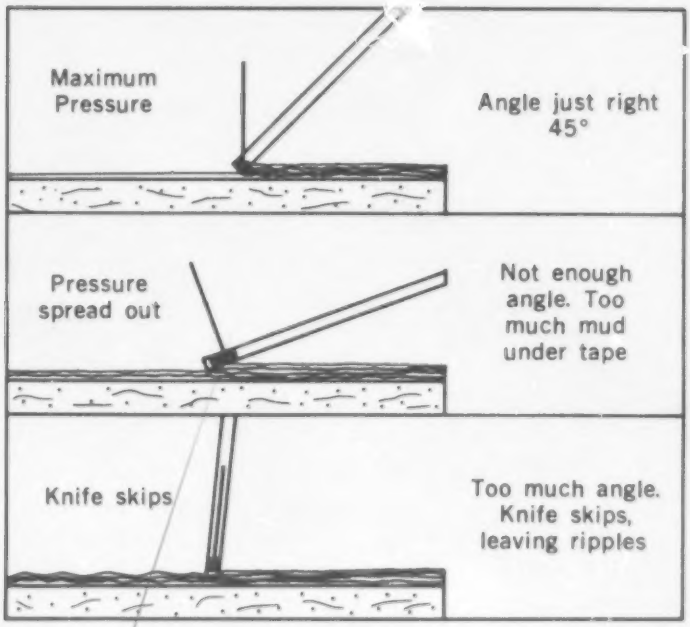

Maximum Pressure
Angle just right 45°
Pressure spread out
Not enough angle. Too much mud under tape
Knife skips
Too much angle. Knife skips, leaving ripples

Figure 4-26
Blade Angle for Wiping Tape

7. Generally, the edge of the tape should look as if it is touching the surface of the paper on the board. There should also be a film of filler extending over the edge of the tape to the board. If there is an abrupt end to the filler at the edge of the tape it means either:
   a. There was not quite enough filler under the tape to feather out. However, there should still be enough filler to adhere the tape to the board, so the tape does not have to be taken off.
   b. Not enough pressure was applied with the knife.
   c. The filler was drying under the tape, in which case the tape should be taken off.
8. If filler underneath the tape does not come out to the edge of the tape it will not adhere to the wallboard. These areas are easy to see as there is a definite dry spot on top of the tape. To remedy a dry spot, pull the tape off the wall for a short distance and put filler from the pan under the tape, then wipe the tape normally, making sure it adheres to the wall. Do not pull off too much tape because it stretches a bit when pulled and could cause a wrinkle. Note that any wiped tape that is removed from the wall needs to have additional filler applied under the tape before it is put back on the wall. Before wiping there is at least 2 mm of filler under the tape. After wiping, there is only half that much and thus not enough filler on a second wiping to flow through the perforations and enter the fibres of the paper. A surface bond may form but it is not as good as a bond with penetration through the tape.
9. The bevels in joints should be full. To fill low bevels, take some filler from the pan and put it on the tape so that the bevel is full, then wipe off the excess. Filling the bevels gives a level base in preparation for successive coats.

10. Don't leave gobs of filler at either end of a tape. Also watch when wiping tapes so that filler does not run off the knife and down the wall.
11. A properly wiped tape should:
    a. Be centered on the joint or hole
    b. Have no wrinkles.
    c. Be tight to the surface.
    d. Have a skim coat of filler on top.
    e. Have feathered edges.
12. To do a good job of wiping, the wiper must watch for taping problems. The wiper should tell the person taping when the filler is the wrong consistency for wiping easily and quickly, when the tapes are too long or too short, and when air bubbles are under the tape. After recognizing problems, the wiper is responsible for correcting them since no one else touches the tape before it dries and other coats are applied. If taping problems are left uncorrected it is difficult if not impossible to make the finished job acceptable.

Wiping Sequence

The wiping sequence is closely related to the taping sequence. In other words, the wiper must follow the system set by the taper. The key to a wiping sequence is that where tapes overlap (e.g., butts at flats, butts at ceiling angle, flats at angles), the underlying tape must be wiped before the overlapping tape is applied. If this isn't done and two unwiped tapes are overlapped, the wiper has to lift the top tape to be able to wipe the bottom one. Extra time will be taken and the wiper will fall behind the taper. In fact the filler will likely begin drying before the wiping can be done.

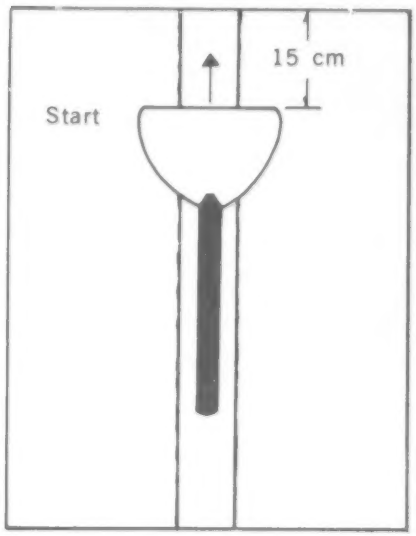


Figure 4-27
Strokes for Wiping
Upper Butts

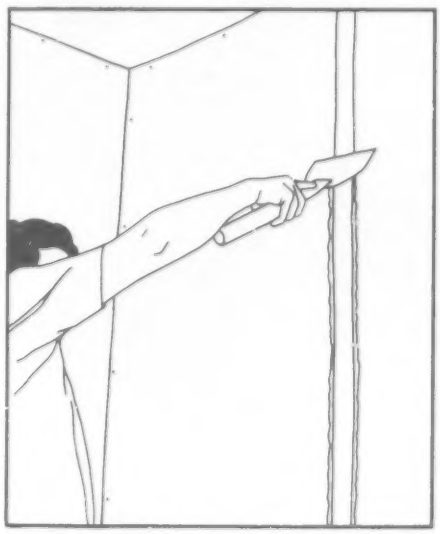


Figure 4-28
Down Stroke on an
Upper Butt

Note that this rule applies to butt and flat tapes but not to angle tapes. At threeways unwiped tapes are overlapped.

Following is a recommended taping-wiping sequence when using a taping machine:

1. Tape ceiling butts — wipe ceiling butts.
2. Tape wall butts — wipe wall butts.
3. Tape ceiling flats — wipe ceiling flats.
4. Tape wall flats — wipe wall flats.
5. Apply short tapes — wipe short tapes.
6. Tape angles, vertical angle, then horizontal angle to the right, and so on around the room — wipe angles in the order they are taped.

Wiping Butt Joints

Upper Wall Butt Joints

1. With the normal grip on the knife place the knife about 15 cm from the ceiling (Figure 4-27).
2. Push up the knife to the top end of the tape. Put enough pressure on the blade to bend it so that it doesn't dig into the tape but rather slides over the tape while embedding it.
3. From the top pull the knife down to the bottom end of the tape at the flat joint (Figure 4-28).
4. Don't leave gobs of filler at either end of the tape.

For lower wall butt joints reverse the direction: push down to the floor from a point about 15 cm from the floor, then wipe up to the flat joint (Figure 4-29). On ceiling butts you can do the short wipe at either end.

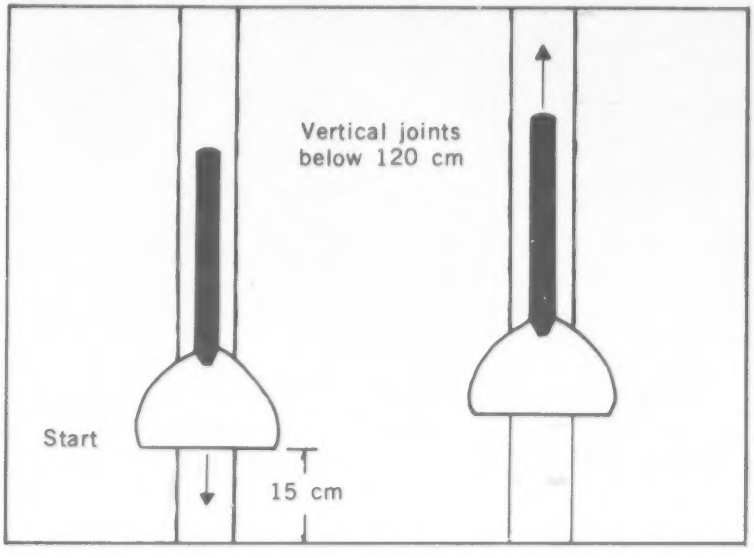


Figure 4-29
Strokes for Wiping Lower Butts

Care must be taken when wiping butt joints not to apply an excess of pressure because it is easy to remove too much filler causing the tape to lift and bubble when filled.

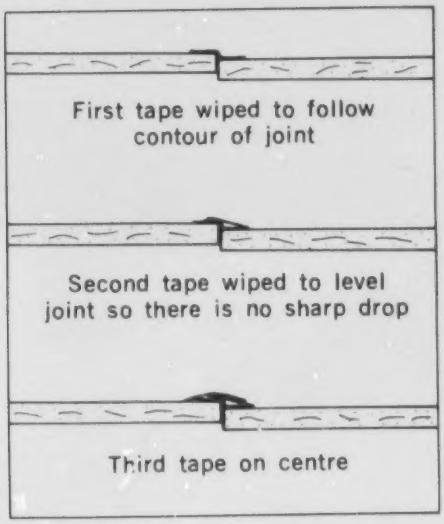

First tape wiped to follow contour of joint
Second tape wiped to level joint so there is no sharp drop
Third tape on centre

Figure 4-30
Taping Uneven Butt Joints

Uneven Butt Joints

If an uneven butt joint has not been pre-filled and is wiped as if it is level, too much filler will be taken off the high side and the adhesion will be poor. This will cause the tape to lift when more filler is applied. For uneven joints wipe the tape twice, once on each side of the centre line of the joint, making sure that each side of the tape has filler under it and that the edges of the tape are tight to the wall. If the difference between the two boards is more than 5 mm, after wiping the first tape to follow the contour of the board (Figure 4-30), put another tape on the joint slightly off to the low side. Wipe this tape normally, making sure not to remove too much filler. When there is a very uneven joint, put a third tape to cover the second tape edge and ensure that the edge will not lift and crack when it is filled. Since there obviously is a lot of extra work in taping uneven butt joints, it is better to pre-fill them before taping.

Eliminating Wrinkles

If a wrinkle occurs while wiping, it must be removed. When the wrinkle is near the end of a tape, pull off the wiped tape a little past the wrinkle, apply filler under the tape, then rewipe it. When the wrinkle occurs past a point where it is convenient to pull off the tape:

1. Cut the tape at the wrinkle.
2. Pull off the tape a centimetre or two on either side of the cut.
3. Put filler under one side, then wipe it in.
4. Put filler overtop of the side of tape just wiped. This step is necessary to bond the two sides together.

5. Put filler under the other side of the tape and wipe it in. This side will overlap the other.

Wiping Flats

Wipe short flats (up to 2 m) the same as butts. To wipe longer flats:

1. Place the knife about mid-length on the tape.
2. Wipe to one end.
3. Return to the midpoint and overlapping the first wipe by a few centimetres wipe to the other end of the tape (Figure 4-31).

Figure 4-31
Wiping a Flat

Figure 4-32
Wiping a Short Tape

Wiping Short Tapes

When wiping short tapes, it is very easy to apply too much pressure on them, sliding the tape away from where it is needed. To prevent this, hold one end of the tape with one hand or with a bottom corner of your pan (Figure 4-32) while pulling the knife towards the other end. A second wipe over the held end will complete the tape.

When a short tape is held in place in this manner you don't have to worry about it sliding and thus can concentrate on applying the right amount of pressure evenly over the tape. Pressure is especially important with short tapes because there is not a lot of filler under them and it is easy if you are not careful to leave a dry tape.

Use a 12 cm knife to wipe short tapes. The width given maneuverability in awkward places yet is wide enough so that not too much pressure is applied. A narrower knife may be needed in some situations but use extra care when applying pressure. When wiping short tapes covering intersecting beads at archways and openings, make certain

that the tape does not extend over the finishing edge of the bead. If the tape is over the finishing edge, it will be knocked loose when the edge is sanded and cleaned, causing cracking of the filler.

Also make sure with short tapes at intersecting beads that the tape is centered over the gap between the beads. If there is not enough tape touching wallboard around the gap, there will not be enough adhesion to hold the tape in place. The corners of an opening in a wall are points of great stress, and even a slight movement will cause an improperly placed and wiped tape to break loose. Make sure there is at least 3 cm of tape on either side for sufficient strength to prevent cracking under normal conditions.

Wipers are usually responsible for ensuring that all necessary tapes are put on. If the taper has missed a short tape that can be easily reached, the wiper should apply it. However, if the missed tape is out of reach or the tape is more than 60 cm, the taper should be called back.

Wipe up to the ceiling

Wipe down to the floor

Figure 4-33
Hand Wiping a Vertical Angle

Wiping Angles by Hand

Angles are the most time-consuming of the joints because each angle has two surfaces to wipe. Also, special attention must be paid to the bottoms and the tops or threeways of the vertical angles. Angles are usually wiped with a narrower knife than is used to wipe butts and flats for three reasons:

1. One side of an angle at a time is wiped, so there is not as much excess filler to wipe off.
2. Taping filler is much harder than topping filler when dry. If you fill wide when wiping you will have to fill even wider on the polish coat to make sanding easier.

3. A wider fill at an angle is not as pleasing to the eye as a narrower one.

Wiping Unrolled Angles (Vertical and Horizontal)

Note: Wiping procedures for the bottoms of vertical angles and for threeways are discussed further on.

1. Treat each side of an angle like a flat. Start about mid-length on the tape and wipe to one end. For vertical angles wipe up first (Figure 4-33).
2. Return to your starting point and overlapping the first wipe by a few centimetres wipe in the opposite direction to the other end (Figure 4-33).
3. Do the same procedure on the other side of the angle. Wipe the two halves in the same direction as the first side. This is necessary to prevent the tape from wrinkling.
4. Be sure that you wipe the angle clean so that the tape is exposed. Leaving too much filler can result in cracking.

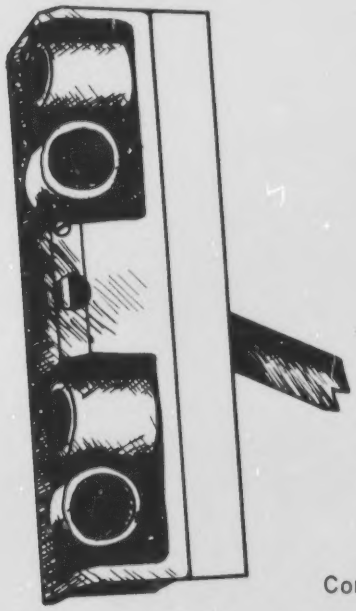


Figure 4-34
Corner Roller Head

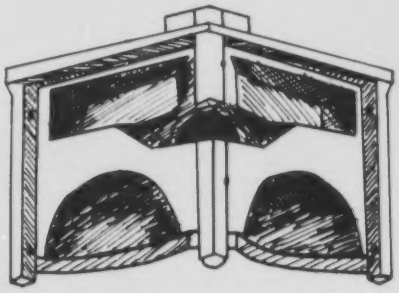


Figure 4-35
Corner Flusher Head

If an angle has been rolled prior to wiping, you can wipe each side straight through from one end to the other. The second side need not be wiped in the same direction as the first. Rolled angles can be treated in this way because the rolling embeds the tape and therefore there is no danger of the tape wrinkling.

When wiping angles be careful, especially with a new knife, that the corners of the knife do not cut the fold in the paper. If the fold is cut, it will crack when the angle is filled since filler is more susceptible to shrinkage and movement without the reinforcement

of the tape. If an angle tape is cut, remove the section of tape with the cut and replace it with a new piece of tape. Make sure that the joins in the tape are tight so that they will not crack or cause uneven shrinkage.

When wiping angles that are close to a bead (within 10 cm), fill the bead with filler from your pan for two reasons:

1. The filler will shrink evenly and leave a level surface.
2. If the bead is to be filled the same day, the heavier filler used for the first coat on the bead will not blend into the thinner taping filler.

Figure 4-36
Rolling an Angle

Rolling Angles

The job of the roller is to push the tape squarely into the angle while embeding it in the filler, and to do it quickly. To roll a vertical angle:

1. Place the roller about halfway up the angle (Figure 4-36).
2. Hold the roller so that it's angle is in the crease of the tape. This gives an even width of tape on either side of the angle. When the tape is not creased, lightly push the roller over the full length of the tape to crease it.
3. Also hold the roller so that the handle bisects the angle. This puts an even pressure on each side of the tape. If the handle is held to the right of centre, more pressure will be put on the left side of the angle and cause the tape to run off to the left. Conversely, if the handle is held to the left of centre, the pressure will be on the right side of the angle and the tape will run off to the right. This rule follows for any 90° angle, whether vertical or horizontal.
4. With light pressure (to prevent the tape from dragging and bunching up in the angle) move the roller to the top of the angle.
5. Again with light pressure, draw the roller down to the bottom of the angle. Be

careful the roller doesn't touch the floor since it will pick up debris and distribute it throughout the angle.

6. With heavier pressure, make a second pass pushing up to the top, then down to the bottom again.
7. Some finishers prefer to make a final stroke up to the top of the angle so they are in a position ready to start the horizontal angle.
8. When filler starts to build up on the roller dip it in water and swirl it around to remove the filler. Also put the roller in water when it is not in use to prevent filler from drying on it.

Basically the same procedures as those for vertical angles apply to horizontal angles. However, extra care must be taken with horizontal angles to avoid dragging the tape; the horizontal angle tapes are usually longer than vertical ones and they have a greater tendency to drag.

Problems When Rolling Angles

If angle tapes drag too much it means either that too much pressure is put on the roller on the first pass or that the roller is started from one end rather than from the middle. Note that if a tape is dragged too much, the tape can fold and catch on the leading edge of the roller.

If a tape is rolled to one side, it should be pulled off from the nearest end past the point where it started to go to one side. Some rolled tapes that are pulled off do not require additional filler, whereas others do to give an adequate bond. The person rolling must make a judgement here. Filler can be placed under the tape by banging the roller lightly into the angle so that filler dislodges from the roller and is left in the angle. This procedure also can be used to place filler on a dry spot under the tape.

If a long horizontal tape that has been rolled has a problem in the middle (i.e., there would be a lot of tape to pull off); or if a tape that is too high to reach conveniently needs repair, they can be corrected by placing a new tape over the faulty one. The first tape should be rolled to bond it to the wall, and the second tape rolled to bond it to the first tape.

Short angle tapes tend to slide with the roller. Roll these by first pressing the tape into the angle with the roller and then rolling the tape with light pressure until it no longer slides. Finally apply more pressure to properly imbed the tape.

Flushing Angles

After the angles are rolled they are flushed. The flushing should leave a thin film of filler covering the tape and a feathered edge. There should be no gaps or large air pockets in the filler.

A flusher is either hinged in the middle or made of a springy metal bent slightly greater than 90° allowing it to deal with small deviations from 90°. However, if the deviations are too large the edges of the flusher or the centre will dig into the tape and strip it off the angle. Note that flushers are not meant to be used on angles that by design are greater or less than 90°. Also, flushers should not be used where one edge of a 90° angle is in contact with a metal bead, concrete, or other hard surface. Either of these surfaces will damage the flusher.

Flusher heads come in two sizes: 8 cm and 5 cm. The 8 cm flusher holds more filler and feathers wider; the 5 cm flusher does not have the holding capacity of the 8 cm and can make more mess as the excess filler can spill off onto the wall.

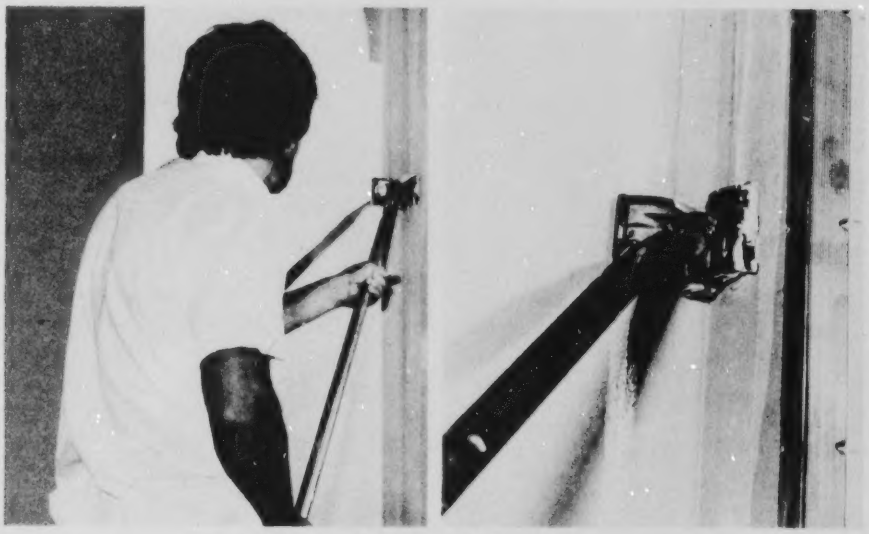


Figure 4-37
Flushing an Angle

Flushing Procedures

1. Start the flusher approximately 8 cm from the floor (the bottom of the angle is wiped by hand). The pointed end of the flusher leads while the blades trail.
2. Hold the flusher so that the handle bisects the angle. Note that the handle has a bend in it, the purpose of which is to apply pressure at the flusher head perpendicular to the angle.
3. Push the flusher into the angle very lightly and lift it up the angle (Figure 4-37). You can increase the pressure as you go up the angle as there will be less danger of the tape dragging. Move the flusher to the ceiling in one motion.
4. Once is usually enough, but always check the angle to see if a second pass is necessary. When there are scratches in the filler, make a second pass after first removing any grit from the flusher blades. Also make a second pass when there are edges or dry pockets in the angle. If these remain after the second pass, it is best to wipe the angle with a knife.
5. As with a roller, when drying filler starts to build up on the flusher, dip it in water and swirl it around to remove the filler. Place the head in water when the flusher is not in use.

Horizontal angles are done similarly. For horizontal angles hold the flusher so that it is about 30 cm behind your trailing shoulder while you walk forward. The bend in the handle should be positioned to apply pressure perpendicular to the angle.

Wiping Angle Bottoms

The roller and flusher take care of the largest portion of an angle, but the ends of the angle must be wiped by hand. A 12 cm knife is best. Before wiping an angle bottom, the floor around the bottom of the angle may have to be cleaned to prevent foreign material getting into the filler and causing scratches. Angle bottoms should take no more than three passes on each side to make them smooth:

1. Apply a thin coat of filler over top of the tape.
2. Wipe the tape tight.
3. Feather the edge.

Tapes that protrude more than 1 cm beyond the wallboard at bottom angles should be cut; not only do they show sloppy workmanship but they are a defect in the finish. Tapes too short are more serious because they leave a gap which may not be covered by the flooring. It is much easier to repair such a gap at this time than after the wall is decorated. Put a small piece of tape over the gap making sure that a sufficient amount of filler is under the tape to give a secure bond.

Note that it is the responsibility of the person wiping the bottom angles to watch for scratches, loose filler, unfeathered edges, unfilled fasteners, or defects in the wallboard up to the 1200 mm point on the wall.

Wiping Threeways

A threeway is where a vertical angle meets two horizontal angles. Wiping threeways is a specialty that some finishers find difficult to do properly. The purpose in wiping a threeway is to make it as square as possible and to make sure that the tape has a very thin coat of filler extending beyond it to form a feathered edge. This provides a level base for the polish coat. Unlike the bottoms where there is only one edge at a time to worry about, the threeways have two edges of tape at a time to wipe, and they run at right angles to one another. Keep in mind however that one cannot spend all day on a threeway — the best job possible must be done in the shortest time possible.

Use three strokes to wipe threeways:

1. Stroke the knife left along the ceiling from the centre of the threeway, the first stoke in Figure 4-38. Both ceiling tapes will be wiped because the blade passes across the tape on the right and parallel with the tape on the left.
2. Stroke from the centre down the left wall, wiping the two tapes on that wall, the second stroke in Figure 4-38.
3. Stroke across the right wall to finish the threeway, the third stroke in Figure 4-38.

When the threeway has been wiped in this manner three of the six tape edges will be skim-coated with filler and have a feathered edge, and three won't. The three that won't be coated and feathered are the edges that the knife blade ran across rather than parallel to the tape. These edges will be coated when the threeway is filled.

The key to doing a good job on threeways quickly is to use the correct angle and pressure on the blade so that excess filler is removed without the tape wrinkling. At first it may take more than one pass on each of the three strokes for the threeway, but with practice only one will be needed.

The most common problem in wiping threeways is caused from the board in the threeway being broken. Broken board prevents the wiper from making the threeway

First stroke Second stroke Third stroke

Figure 4-38
Wiping a Threeway

square. The broken part must be cut away and the hole filled with filler. If the amount of board cut away leaves a large hole, several layers of tape may be necessary to cover it.

Vapor barrier plastic can also cause problems at threeways because it often protrudes between the boards. Sometimes you can see the plastic sticking out from under the tape while other times you will have a noticeable difficulty in squaring off the angle. The plastic must be cut out and the tape replaced and wiped square, making sure enough filler is under the tape.

If a tape is too long at a threeway, it must be cut back to the length that will enable it to fit into the angle without folding or bunching. If the tape is too short, add a piece that reaches the corner.

Wiping Non 90° Angles

Occasionally you will have to wipe angles that by design are greater or less than 90°. These angles should all be wiped by hand, even if a roller will fit the angle. One reason for wiping angles greater than 90° by hand is that a roller is difficult to hold in the centre of these angles and thus there is a tendency to run the tape to one side. Another reason is that there is usually a gap in the joint of angles greater than 90° and the roller forces the tape into the gap between the two boards and accentuates the problem. On angles less than 90° the edges of the roller will dig into the wallboard and not touch the tape.

If there is a gap of more than 6 mm between the edges of the boards on non 90° angles and no pre-filling has been done, two tapes should be applied, one to fill in the gap and the other to bridge the joint.

Sometimes if an internal angle is close to 180° it may be desirable to take the point out of the angle by rounding it off. But, before doing so, check to see if any cabinets are being placed in the angle or if any trim is being used that would prohibit rounding the

angle. Also make sure that no more than 5 mm of filler will be necessary on top of the tape to round the angle. Rounding is achieved with a flexible knife, preferably 12 cm or wider. The width of the knife governs the length of the round or arc: the wider the knife the longer the arc and consequently the more filler that is put on the tape.

To round out an angle:

1. Center the knife about mid-length on the angle.
2. Put either one or two fingers in the centre of the blade and apply pressure to bend the knife. Applying steady pressure with the bent knife, move the blade down to the angle bottom lightly imbeding the centre of the tape.
3. Check the tape to make sure that the edges of the tape are wiped tight to the board. If not, repeat the stroke applying more pressure until the edges are tight.
4. Return to the starting point and wipe the upper section of the angle in the same way.

When wiping angles greater than 90°, a finisher with a steady hand can pull the knife along to form a straight line. Note that the same pressure must be maintained on the knife to keep the tape even. Those with an unsteady hand should use a straightedge (for example, a piece of corner bead) to guide the knife (Figure 4-39). The straightedge is held parallel to the angle and the edge of the knife is run against the straightedge.

Flexible bead works well in internal angles greater than 90°. The angle is loaded with filler the same way as with tape. The flexible bead is cut to length and placed in the angle with the metal side facing out, then wiped down like tape. The metal makes it very easy to get a straight angle.

Figure 4-39

With angles less than 90° a special knife is required. An old knife can be ground down so that the working edge is at an angle to the line of the handle. These angles may then be wiped in the same way as a 90° angle.

Cleanup After Wiping

Whenever wiping tapes, take care to leave a clean job. This holds for the taped joints, the walls, ceilings, floors, and also for yourself. Remember that wiping prepares the foundation for the rest of the filling. The cleaner and smoother the foundation, the easier it will be to produce a smooth flat finish. A clean wiping job shows your skill as a finisher.

It is the responsibility of the wiper to check the entire wall for splatters or runs of filler. When these are removed while wet, they leave only a thin film of filler that poses no problem. On the other hand, if a lump of filler is let dry and must be sanded, the paper may be roughed up and will then have to be coated to be made smooth again, all of which is a waste of time. Get into the habit of checking the walls before you leave a room and removing any spatters or runs while they are wet.

Dry lumps of filler are especially a problem when filling machines are used to fill the angles. Machines do not compensate for a lump of dry filler; they either go over the lump, accentuating it with more filler or drag the dry filler along the angle or joint. A taping filler lump is made of a harder compound than topping filler. When the lump is sanded after the topping filler is applied, the topping filler will be removed from around the lump creating more problems. The obvious solution is to leave the walls clean to start with.

Other parts of the room should also be kept clean. Floors can be kept clean by placing scrap filler on old bags or plastic positioned where they won't be stepped on. Window sills, windows, doors, door frames, and heat registers should also be kept clean. In fact, after wiping the only place where filler should be is on the joints, angles, short tapes, and beads.

Keep yourself clean too. For example, wipe your knife on the pan, not on your pants.

Wiping Butts and Flats Sleuth Sheet

Problem	Cause	Solution
Tape wrinkles.	1. Uneven pressure when wiping.	1. Hold knife at angle close to 90° and develop wrist and arm muscles.
	2. Uneven amount of mud under tape owing to uneven edges of board.	2. Wipe one side, then the other.
	3. Wiping tape from one end and not from middle.	3. Start in middle of tape and work to the ends.
	4. Wiping angles up on one side and down on the other.	4. Wipe both sides of angle in the same direction.
	5. Tape not put on straight.	5. Straighten tape before wiping.
	6. Something under tape.	6. Remove object under tape, re-mud, and wipe back in place.
Bubbles on the surface of the tape.	1. Knife skips on the tape.	1. Knife is held too close to 90°. 2. The pressure on the knife is not even.
Not enough mud to fill.	1. Not enough mud under tape.	1. Put mud in area and re-wipe.
	2. Bevel too wide.	2. Put mud in area and re-wipe.
	3. Mud too thick.	3. Ask the taper to thin the mud and fill bevel and re-wipe.
No mud protruding from edge of tape.	1. No mud under tape.	1. Pull tape back, put mud under and re-wipe.
Mud falling on wall.	1. Mud building up on blades of knife.	1. Hold knife so that bottom edge is leading edge.
	2. Knife too narrow.	2. Clean knife more often. Use wider knife.
	3. Too much mud under tape (hand taping).	3. Ask the taper to adjust gate for less mud.
	4. Mud too thin.	4. Ask the taper to thicken mud.

Module 4

Wiping Butts and Flats Sleuth Sheet

Problem	Cause	Solution
Tape appears to have no mud under it.	1. No mud under tape when applied. 2. Wiped too hard. 3. Mud too thin. 4. Uneven board.	1. a. Check with taper. b. Re-mud and wipe. 2. a. Decrease angle of blade to wall. b. Decrease pressure on knife. 3. Ask the taper to thicken mud. 4. Wipe high side then low side, filling in low side.
Tape appears to be sitting too high.	1. Mud too thick. 2. Not wiped hard enough. 3. Knife not filed to square edge.	1. Thin the mud then re-mud and wipe. 2. a. Increase pressure on knife. b. Increase angle of knife. 3. File knife with single cut mill bastard file to achieve square edge.
Knife pulls tapes away from wall at intersecting joints.	1. Previously wiped tapes not wiped tight enough. 2. Angle of knife too great.	1. Re-wipe previous tape after re-mudding. 2. Decrease angle of blade; increase pressure.
Mud under tape has become too stiff to wipe.	1. Chemical reaction between board and filler. 2. Chemical reaction between mixed fillers. 3. Tape has been left too long.	1. Remove tape; contact person in charge; change of filler required. 2. Clean pails, discard mixed material and mix new batch using one type of filler. 3. Remove tape, scrape off dry filler, re-tape.

Wiping Angles Sleuth Sheet

Problem	Cause	Solution
Flusher pulls tape along angle.	1. Angle not 90°. 2. Tape not tightly rolled. 3. Flusher started too close to end of tape. 4. Too much pressure. 5. Wrong end of flusher pointed forward.	1. Wipe by hand. 2. Replace tape, roll again, then re-flush. 3. Flusher should be started about 8 cm from end of tape. 4. Decrease pressure on flusher. 5. Pointed end of flusher leads, blades trail.
Angle has wallboard on one side, concrete or metal on other.	1. Design of building.	1. Roll lightly on the concrete and wipe by hand. 2. Roll tight on metal and wipe by hand.
Angles not square.	1. Knife rounded on corners. 2. Tape not properly creased. 3. Mud too thick. 4. Angle not rolled tight.	1. File knife square. 2. a. Crease tape before applying to angle. b. Use creasing wheel in angle. 3. Mud should be thinner than mud for flat tapes. 4. Put more pressure on roller.
Angles cut in corner.	1. Corners of knife too pointed. 2. Shoe on flusher worn out.	1. Blunt corners of knife on cement or file; retape angles. 2. Repair flusher.
Wrinkle in angle.	1. Opposite sides of angle wiped in two different directions. 2. Tape not rolled precisely in corner.	1. Wipe top or bottom in same direction both sides. 2. Hold roller to bisect angle. Remove tape and roll properly.

Wiping Angles Sleuth Sheet

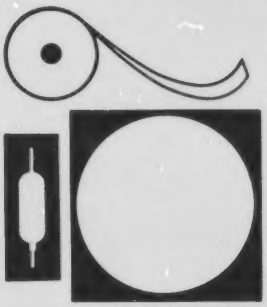
Problem	Cause	Solution
No mud protruding from under edge of tape.	1. Mud too thick.	1. Thin down mud, remove tape, scrape out filler and replace mud and tape.
	2. No mud under tape.	2. Pull up tape, apply mud, and retape.
Tape sits too high.	1. Mud too thick.	1. Thin down mud, lift tape, remove mud, and retape.
	2. Lump under tape.	2. Lift tape, remove lump, re-mud, and retape.
Tape off to one side.	1. Tape not applied to centre in angle.	1. Crease in tape should be centred in angle before being wiped or rolled.
	2. Roller not bisecting angle.	2. Handle should bisect angle.
One side of angle looks clean while other side looks loaded.	1. Flusher not bisecting angle.	1. Run flusher over angle again, making sure handle bisects angle.
	2. Angle not 90°.	2. Wipe by hand.
Flusher leaves no empty spaces.	1. Uneven pressure on flusher.	1. Once started, angle should be run all the way. One arm should be braced or held rigid so that pressure is even.
	2. Pressure too far forward on flusher.	2. Flusher should be placed approximately 30 cm behind shoulder.
	3. Mud too thick.	3. Mud should be thinned; angles should be flushed again.
Flusher leaves no skim coat.	1. Not enough filler on flusher head to leave the skim coat.	1. Dip the flusher head in filler before flushing the first angles.

Wiping Angles Sleuth Sheet

Problem	Cause	Solution
Mud not feathered.	1. Not enough pressure on angle flusher.	1. Run flusher over angle again with more pressure. If still not feathered, angles should be wiped by hand,
	2. Mud too thick.	2. Thin out mud; wipe angle by hand.
	3. Knife held too flat with not enough pressure on feathering edge.	3. Increase angle of knife and put pressure on feathered edge.
	4. Blade not filed square.	4. File blade so that edge shears filler.
	5. Angles not 90°.	5. Wipe by hand.
Tape too long.	1. Tape cut too long.	1. All long tapes should be cut to within 5 mm of end of joint.
	2. Tape dragged along angle by roller or flusher.	2. Start rolling and flushing angle with light pressure then increase pressure on passes.
Tape too short.	1. Tape cut too short.	1. All short tapes should be added to by the wipers, who should carry tape with them.
	2. Tape drag by roller or flusher.	
Flusher tears tape.	1. Too much pressure on leading edge of flusher.	1. Position flusher approximately 30 cm behind trailing shoulder.
	2. Angle not 90°.	2. Wipe angle by hand.
	3. Wrinkles in tape.	3. Lift flusher off angle at wrinkle and cut wrinkle, then wipe by hand.
		4. Torn tape should be remudded then put back in place and wiped.

EXERCISE

1. What type of knife should be used for wiping flat and butt tapes applied by hopper or machine?
2. How do you eliminate the problem of tape wrinkling?
3. What regulates the amount of filler left under a tape when wiping?
4. If filler does not reach the edge of the tape, what needs to be done?
5. List five characteristics of a properly wiped tape.
6. Who is responsible for correcting taping problems?
7. If you have cut a tape to remove a wrinkle and have wiped one side down, what must be done before wiping the other side?
8. Why is the pressure applied to a short tape especially important?
9. How much tape is required on either side of a gap for proper adhesion?
10. How long should a missed tape be to justify calling the taper back?
11. What size knife is generally used for wiping angles?
12. How are wrinkles avoided when wiping unrolled angle tapes?
13. Why is it important not to tear wiped angle tapes in the centre?
14. How should a roller and a flusher be held in relation to the angle?
15. What happens if too much pressure is applied to the roller on the first pass?
16. What will happen if the handle of the roller is held to the right of centre of the angle?
17. What is the preferred size of flusher for wiping angles?
18. If dry pockets persist after a second pass with the flusher, what should be done?
19. How far beyond the wallboard can tape extend and still be acceptable?
20. What are the other responsibilities of the person wiping the bottoms of flushed angles?
21. How many strokes are required to wipe a threeway?
22. How many strokes should it take to wipe the bottom of an angle?
23. Why is it best not to use a roller when wiping angles greater than 90°?
24. What factors must be considered before angles are rounded?
25. What are two ways of ensuring that angles greater than 90° are straight?



Filling

MODULE 5

INTRODUCTION

Filling is the test of the drywall finisher to produce quality work: it is here where the finisher's skill shows up most. Besides using hand tools skillfully, the finisher also must have a knowledge of filling compounds and how they are affected by temperature and humidity. Other factors that have a bearing on a good filling job are the boarding, beading and taping that are done before the filling begins. Even the best finishers will have a difficult time turning out a quality filling job if the procedures that precede filling have been done incorrectly.

Filling and sanding are the finishing touches to drywall surfaces. When completed the drywall job should have fasteners filled flush, straight bead edges and full beads, butts and flats filled with maximum rise of 2 mm in 1200 mm, angles square, all edges feathered, and all filler surfaces smooth and blemish-free.

The Right Filler For the Job

Four types of filler can be used for filling: taping, topping, all-purpose, and fast-setting. Taping filler should be used only for first coating since it has a lot of glue and dries very hard making it difficult to sand. In addition, the fibres in taping filler make sanding it a higher health risk than sanding topping filler. The strong bonding of taping filler makes it ideal for a first coat on fills less than 2 mm deep. Fills deeper than this will check or crack.

Since topping fillers have a high rate of shrinkage, they are mainly used for final coats. However, some pre-mix topping fillers have a unique gel stage which considerably reduces the amount of shrinkage making them suitable for all filling coats. These are not fast-setting materials because they do not rely on crystal growth. Generally though, topping fillers are used for skim-coating on a surface to make it smooth. Because topping fillers are sanded, they do not contain as many fibres as taping filler.

All-purpose fillers can be used for all taping and filling coats but because they are formulated for general use, they do not perform as well as taping fillers do for taping or topping fillers do for final coats.

Fast-setting filler is best suited for deep fills because its setting action produces expansion of the filler and eliminates shrinkage. Since fast-set has a tendency to produce an overfill, it is desirable to underfill with it to allow for expansion. Fast-set should not be used for a finishing coat; it should have a skim coat of limestone-based filler to prepare it for paint.

It is important to know which filler to use and where. If a slow-setting filler is used for a deep fill, it is possible that the filler will crack and fall off the wall. Using taping filler in place of a topping filler will result in a hard surface that is not easy to sand and has a coarse finish. Most topping fillers are white, so they are easily hidden by paint, whereas taping fillers are generally darker and may show as a discolored area after painting.

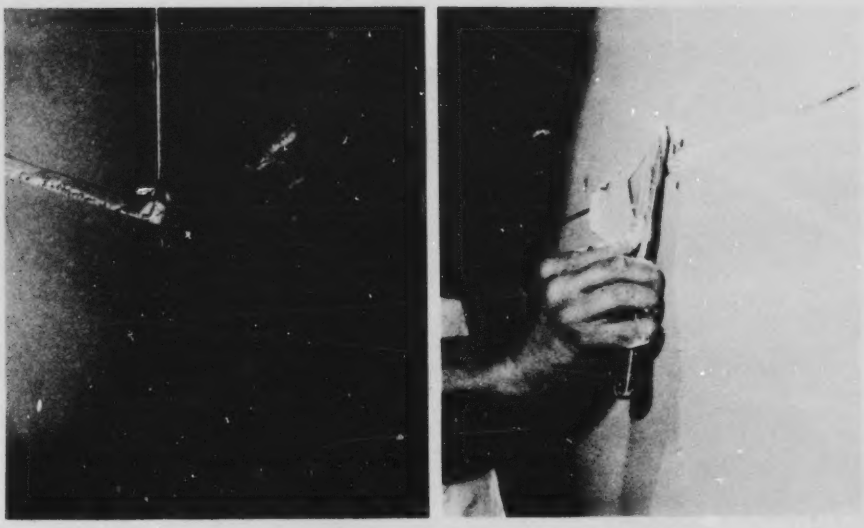
Pre-Filling

Pre-filling is very important in turning out a good finished product. Problems like broken board and wide gaps between boards are common. These areas must be filled prior to taping to provide a level base for successive coats of filler. Uneven surfaces cause uneven shrinkage and thus an uneven finished surface. An extra coat will be required to finish the surface, and the best time to apply it is before the tape is put on.

If pre-filling is done with slow-setting fillers, it must be done at least 24 hours before taping to ensure that the filler is dry and that shrinkage has already occurred. When the pre-filled areas are dry, the rate of shrinkage is the same for the entire length of the tape and there will be a flat surface upon which to put successive coats. If a fast-setting filler is used, wait until the filler has set before taping over it, anywhere from 15 to 90 minutes.

The most obvious areas to pre-fill are the gaps between joints. All joints should be tight but a gap of 5 mm is acceptable. Wider gaps must be filled and, if necessary, pre-taped. Uneven butt joins are not quite as obvious but can be found by looking for shadows or running your hand along the joint. Enough filler should be applied to level out the two edges (Figure 5-1). Broken board should be cut out and the paper removed to a point where it is firmly fastened to the core (Figure 5-2). Loose paper should be torn off. Apply tape to any exposed core of the board unless a normally applied joint tape will cover it.

Figure 5-1
Pre-filling Uneven Butt Joints



Cut out the broken board Pre-fill the gap

Figure 5-2
Pre-Filling Broken Wallboard Corners

Holes around electrical outlets and pipes also should be pre-filled so that the tape has a solid base to adhere to. The pre-filling also provides strength so that the tape will not crack when pressure is applied. Clean excess filler out of the receptacle and from around the pipes.

An area often overlooked when pre-filling is that around fasteners. Broken face paper and broken core material around fasteners are major problems. If not properly treated they will develop into nail pops as the board becomes loose and the filler covering the fastener cracks. Cut out and remove the loose paper and core material and then tape over the hole. Put a new fastener within 3 cm of the old one because once the core of the board has been shattered the fastener looses its holding power.

Pre-filling is also necessary for nails (not screws) in joints to ensure a level surface and even shrinkage in the finishing coats. Some finishers will say that filling nails in joints isn't necessary reasoning that they are filled when the tape is wiped. But this is wrong. Taping filler is thin and has a high rate of shrinkage so the nail depression, being deeper, shrinks more. Also, if two closely placed nails in a joint are not filled before taping, a trough will be formed between them when the joint is filled later. Nails that are placed within 10 cm and 30 cm of the finishing edge of bead should also be pre-filled before the bead is loaded. Because these depressions are below the surface of the board, they shrink more and need an extra coat of filler.

Telling If Filler Is Dry

To avoid delayed shrinkage it is very important that filler be dry before successive coats are applied. Once dry filler is stable and will no longer shrink. There is no magic or highly trained sixth sense required to tell if filler is dry. Using your eyes is a good

start. Filler, when put on the wall, is shiny from the moisture. As it dries, it dulls and turns white or to its color in powdered form. When watching filler dry, it becomes obvious that it dries from the shallowest to the deepest fill. Bead dries last closest to the finishing edge of the bead, flats dry last in the middle of the joint, butt joints just to either side of the tape, and angles in the apex of the angle. Therefore, when checking a fill to see if it is dry, look at the area where the fill is the deepest. The second test is the touch test. Dry filler is hard, and when tapped lightly with a fingernail no mark is left on the surface. The wetter the filler the deeper the mark. Again, this test is done where the fill is deepest.

A moisture meter can be used to check the moisture content of filler. Wet filler will register from 8 per cent upward. Dry filler will register from 0 to 6 per cent. Again, the readings should be taken where the fill is deepest. Also make sure that the prongs on the meter do not contact metal because this will produce a false reading.

Drying charts are available (see the example at the end of Module 8) that estimate the drying time for filler under given temperature and humdity conditions. Remember though that the drying times on the charts are only estimates and should be confirmed by the sight and touch test.

Types Of Filler Coats

The deciding factor in determining how many coats are required to properly finish fasteners, flats, butts, angles, or bead is what kind of finish will be put on the wall. This information can be found in the architect's finish schedule or blueprints, or by asking the person in charge of the site. When a complete set of coats is made such as on beads and fasteners, it generally takes two coats to level out or "load" the areas and a third to finish or polish the surface.

The industry standard for coats of filler for a paint finish is:

Fasteners	— 3 coats
Flats	— 2 coats
Butts	— 2 or 3 coats
Angles	— 1 coat
Bead	— 3 coats

The industry standard for coats of filler for texturing is:

Fasteners	— 2 coats
Flats	— 1 or 2 coats
Butts	— 2 coats
Angles	— no coats if wiped properly
Bead	— 2 coats

First Coat (Loading Coat)

The first coat on fasteners, butts and bead is also called the loading coat. The first coat deposits the greater part of the fill applied during the several coats of the filling process. A thick mix of filler is used which reduces shrinkage. When removing the excess fill, the angle of the blade is held at less than 45 degress to the wall.

Although the amount of filler that should be left after the first coat varies with the type of filler, the following general rules apply:

- Powdered fillers usually shrink the most and so the joints and beads should be left slightly over full.
- Pre-mix fillers usually shrink less and so a level fill is desirable.
- Fast-setting fillers expand and so the fill should be slightly hollow.

Note that to know accurately the amount of shrinkage or expansion of a filler, the filler has to be tested under job conditions.

Because fillers used for the first coat dry to a hard surface the fill must be narrow and the surface should not be rippled or ridged. Small air holes in the surface are not of great concern on the first coat.

Second Coat

The second coat on fasteners, butts, and bead must accomplish two things:

- Fill any shrinkage from the first coat.
- Form a smooth surface in preparation for a third or polish coat.

Flats do not receive a loading coat, so the first coat on flats is what is being called here a second coat.

Filler for the second coat is mixed thinner than that for the first coat because the second coat fill, having much less depth than the first coat, has little shrinkage. The thinner filler is necessary to provide a smooth surface. Topping filler is commonly used for the second coat because it not only produces a smooth finish, but makes sanding the final coat easier. The second coat should be wider than the first coat, be smooth, and be blemish-free.

The angle of the blade is held at 45 degrees for the second coat.

Third Coat

The third coat, also known as the final coat or polish coat, on fasteners, joints and bead should:

- Completely cover the previous coats.
- Leave a smooth, flat, level surface ready for finish sanding and decoration.

Note that angles do not receive a first or second coat, only a third or polish coat.

The polish coat is accomplished by using thin topping fillers and by holding the angle of the blade at greater than 45 degrees to the wall. Enough pressure must be applied to the blade to remove most of the filler. The thin filler used for the polish coat has a high rate of shrinkage (due to its high water content) but this is of no concern because the depth of fill is negligible.

The preference for a hard or soft topping filler for the finish coat varies from region to region. Common to all regions, however, is that a smooth finish must be produced.

Skim Coat

A skim coat is a very thin coat of filler applied to a wall to seal off the wallboard, remove any minor imperfections, and equalize the suction of the wallboard. A skim coat is put on for a highly reflective decoration, or when a light source will shine across the wall.

Filler used for skim coating is mixed thin similar to that used for the third coat (and also similar in consistency to the filler used on angles with machines). A coat of filler is applied and immediately removed before the filler has a chance to lose moisture and thicken. A stiff blade is best for this so that a minimum amount of pressure is required to skim the filler off the wall.

Starting at the top of the wall, apply filler to the wall. With the blade close to a 90° angle to the wall, draw the blade back across the filler to remove the excess. Properly done the wallboard will be visible through the skim coat. If too thick a coat of filler is left on the wall, the chances increase for blemishes such as ridges, air pockets, and scratches. In leaving too much filler the purpose of the skim coat is defeated.

Some key points to remember when skim coating are:

1. Joints and beads must be skimmed parallel to the edge of the fill.
2. Small ripples must be skimmed parallel to the edge of the ripple to remove them.
3. Any shaking of the blade during the skimming process will leave an uneven skimmed surface.
4. When skimming over a filled area, the filler will stiffen quickly, so remove the filler from these areas promptly.
5. Exchange the filler on the blade as often as necessary to ensure you are using thin filler, to leave a uniform amount of filler on the wall, and to minimize muscle strain.
6. A good skim coat should have a uniform hazy white appearance with all previously filled areas visible as more solid white areas. White streaks in the skim coat indicate ridges or buildup in the coat.

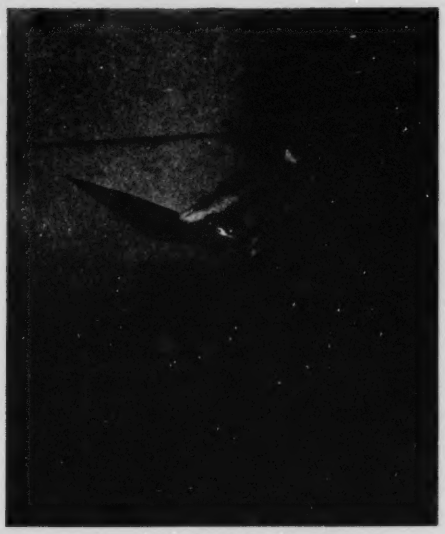


Figure 5-3
Correct Knife Grip for Filling

Holding A Knife For Filling

For good results, the grip on the knife is important whether the knife be a broad one for filling beads and joints or a narrow one used for touch-up. The thumb should be on one side of the handle, the index finger on the blade just below the handle, and the remaining three fingers on the other side of the handle (Figure 5-3). This three point grip allows the blade to be pivoted on the index finger and pressure to be easily applied to the blade.

Generally, a softer blade is desirable for touching up fills and angles, and for third coats on joints and beads. A stiffer blade is better with the thicker filler used for the first coat on bead and fasteners.

All knives will have a slight bow. Loading should be done with the bow away from the wall and touch-up with the bow to the wall.

Holding A Trowel For Filling

The way you hold a trowel will determine the control you have on your arm and thus the quality of your filling. The correct way is to hold the trowel with the knuckles of your hand facing the ceiling (Figure 5-4). The reason for the knuckles-up grip is that it enables you to lock your arm in a rigid position. When your arm is rigid, the trowel is stable and thus the fill is consistent.

Besides giving trowel stability, the knuckles-up grip allows you, by rotating your wrist slightly, to move the trowel in a continuous pass over a distance of two metres or more. Such long strokes are advantageous because they produce a straight, parallel edge, eliminate hollow spots in bead, and leave a minimum number of lift-offs.

Figure 5-4
Correct Trowel Grip for Filling

Figure 5-5
Arcing off a Loading Pass on Bead

Basic Filling Passes (or Strokes)

Four basic passes are made in the filling process: loading, feathering, removing the excess, and cleaning the finishing edge (on bead).

Loading

The purpose of the loading pass is to apply an excess amount of filler to beads and joints which is then worked to a smooth level surface. Points to watch for when loading are:

1. Make sure that more filler is put on the bead or joints than is required for the coat.
2. Loading passes on bead should be finished off with an arc across the finishing edge (Figure 5-5).
3. The surface of the filler after a loading pass should be as uniform as possible.
4. The width of the filler should be uniform and be no wider than the width for the coat being applied.
5. Time should not be wasted when loading by making more than one pass on a given spot, as this will cause the fill to be hollow.

Loading filler onto a bead, joint, angle or fastener requires the same technique. When the technique is mastered, filler can be loaded over long distances producing uniform fills and edges.

The key to the loading pass is to change the angle of the blade to the wall as the trowel is moved forward. By decreasing the angle at a constant rate all the fill on the blade can be uniformly applied to the wall. The following actions must occur when making a loading pass:

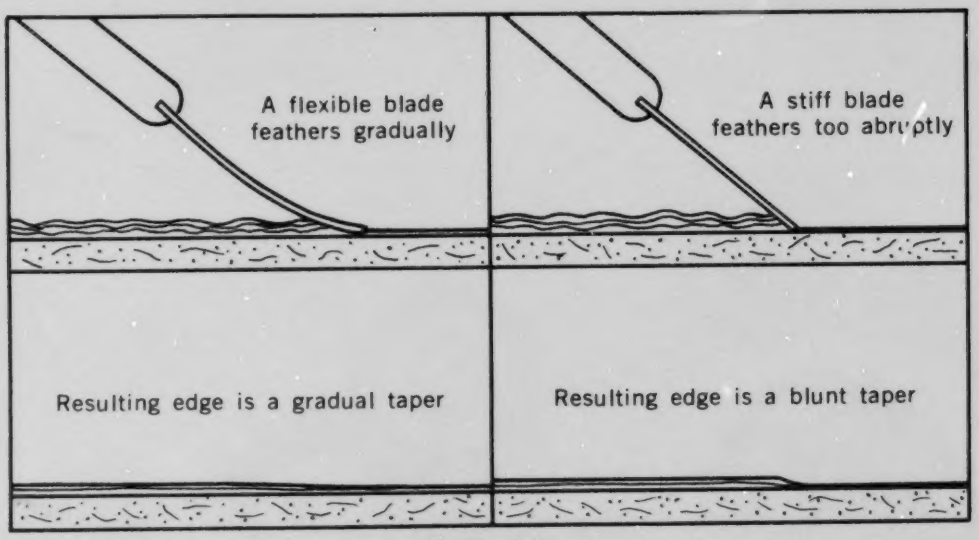

A flexible blade feathers gradually
A stiff blade feathers too abruptly
Resulting edge is a gradual taper
Resulting edge is a blunt taper

Figure 5-6
Correct Blade for Feathering

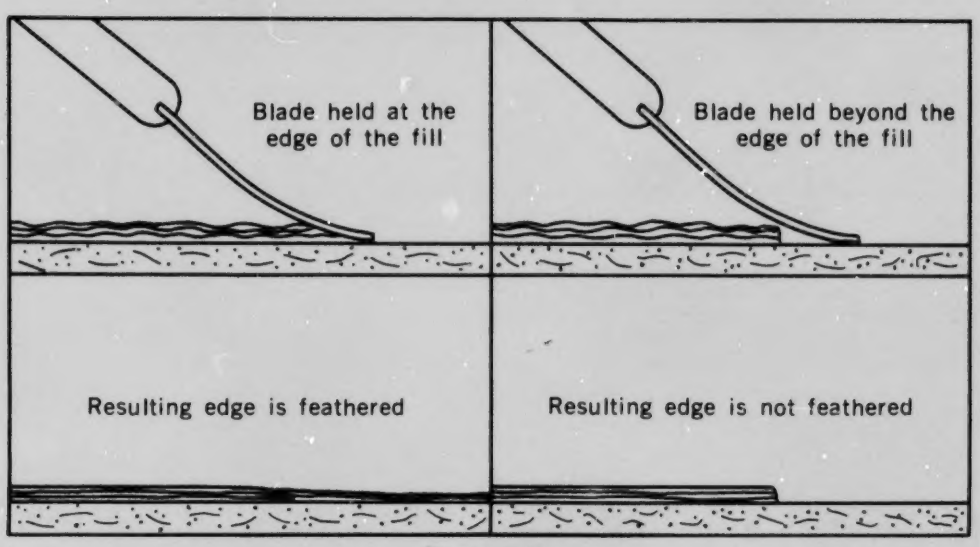

Blade held at the edge of the fill
Blade held beyond the edge of the fill
Resulting edge is feathered
Resulting edge is not feathered

Figure 5-7
Correct Blade Position for Feathering

1. Place the filler in the middle of the blade.
2. Maintain a constant speed while moving the trowel across the wall.
3. Decrease the angle of the blade to the wall as it moves forward.
4. Increase pressure on the blade as the angle increases.

Generally, the thicker the filler the slower the loading pass is carried out. With thin filler the pass must be fairly quick.

Feathering

The purpose of the feathering pass is to blend the edges of the filler into the wallboard. The main concerns when feathering are:

1. The edges of the filler should taper off into the wallboard leaving a smooth, continuous surface.
2. The feathered edge should be straight.
3. A feathering pass should be as long as possible.

Feathering is a very important part of the filling process. It decreases the amount of sanding and is a sign of good quality work. To feather filler, the blade must be flexible enough to allow a tapering of the filler. A flexible blade will allow the gradual decrease in thickness of fill until there is virtually no filler on the wall at the outside of the fill (Figure 5-6). A stiffer blade has a tendency to make the decrease in filler too abrupt (Figure 5-6).

Besides blade flexibility, the position of the blade also affects the edge formed. By placing the end of the blade on the edge of the fill (Figure 5-7) the proper feathering taper will result. On the other hand, if the end of the blade is held beyond the fill, the edge will not taper off and an abrupt edge will result (Figure 5-7).

Other factors affecting feathering are the filler formulation, the face paper of the wallboard, and the thickness of the filler. A problem with the raw materials that formulate the filler may make it difficult to shear, resulting in a rough or grainy feathered edge even when proper feathering technique is used. Such an edge can also result when the wallboard face paper is not smooth. Thick filler is always harder to feather out because it does not spread as easily and it is harder to get the proper blade angle with it for feathering. When confronted with these adverse conditions, finishers have to pay closer attention to feathering the edges.

Removing the Excess

The purpose of the removing the excess pass is, as its name implies, to remove the excess filler applied on the loading pass and in so doing flatten and distribute the filler to produce a level surface. The main concerns when making this pass are:

1. The surface of the filler should be left smooth.
2. For bead:
   a. The bead should be full.
   b. Prior to making the pass, short strokes are made at the bottom of the bead to eliminate a "baseboard" of filler.
3. Joints in the filler should have a very small lift-off.
4. Ridges or lines should not be left in the filler.
5. The pass should be as long as possible.

The number of passes to remove the excess is critical. It is possible to reduce the number of passes by improving your technique and skill. Making more passes removes too much filler and invariably leaves the fill hollow.

Joining Wet Filler

During any coat of filler you will have to join a fill to wet filler. When making the join, the object is to leave the least amount of lift-off as possible. Move the trowel 15 to 30 cm beyond the join. As the trowel passes over the join, begin a combination of movements:

1. Gradually release pressure on the trowel until it is lifted from the wall.
2. In a sweeping motion, revolve your wrist to bring the blade perpendicular to the line of fill at the point where it is lifted from the filler.

Rough Sanding

Always wear a mask when sanding. Be safe: wear only a mask that has been purchased at a safety-supply store, since it will be one that has been approved for adequate protection.

The intent of rough sanding is to remove lumps or ridges from previous fills on joints, angles and beads. Fasteners should never be rough sanded. The better the finisher, the less rough sanding is required. Rough sanding is not often necessary for the skilled tradesman. At most, rough sanding should be a light brushing or scraping; it should not be a method of correcting poor filling techniques. Rough sanding can be done by:

1. Using 80 grit sandpaper on a pole sander.
2. Scraping the surface with a blade.

Rough sanding when properly done, should:

1. Be done quickly.
2. Remove edges, ridges and lumps.
3. Clean the finishing edges of bead.
4. Not buff the face paper of the wallboard.

Depending on the quality of the taping job or the coat of fill, bead, joints and angles may need rough sanding after taping and between successive coats of filler.

When rough sanding bead, place the sander horizontally on the wall. One pass up and one down will remove excess filler on the edges. Ridges left where filler was joined must also be removed; if not they may show through the finished job because the next coats of filler shrink around the ridges and accentuate them. Removing ridges is especially important when a combination of taping and topping filler is used. If no rough sanding is done to remove ridges in the taping filler, when the job is finish sanded the softer topping filler will be removed from around the ridge in the harder taping filler, leaving a ridge in the finished product. One pass up and one down with the head of the sander perpendicular to the edge of the bead, with special attention to ridges and edges, should be sufficient. To remove big ridges sand them with the head of the sander moving parallel to the ridge.

When rough sanding joints between coats, apply greater pressure to the centre of the joint than on the edges. Do not sand the filler down to the tape. One pass down the middle of flats and butts with the head of the sander perpendicular to the joint, paying special attention to the edges, is sufficient. Angles need four passes to clean them off, one up and one down each side. Take care not to tear the tape or the surface of the board. Fasteners should not have to be sanded between coats, but if the edge around the fastener is not properly feathered it may be necessary to lightly sand the spot to remove the edge. In general, however, fasteners are not rough sanded as the paper could be torn and show through the final decoration.

Filling Vertical Bead

A medium-stiff blade is desirable for filling bead so that less pressure will be needed to remove the excess filler. The filler is mixed relatively thick for bead. The stiffer the blade the less chance there is of removing too much filler and leaving the bead hollow. To leave the filler level use a slightly convex curved trowel to compensate for the pressure applied on the trowel.

Most vertical bead will have to be done in two sections: the bottoms or the part of the bead that can be comfortably reached from the floor; and the tops, the part that requires stilts or a scaffold to reach. Note that the top of a vertical bead must be filled while the bottom is still wet, otherwise uneven shrinkage and a crack will occur where the filler joins. When tying tops in with bottoms always keep a small amount of filler on the blade to avoid pulling the partly dry filler.

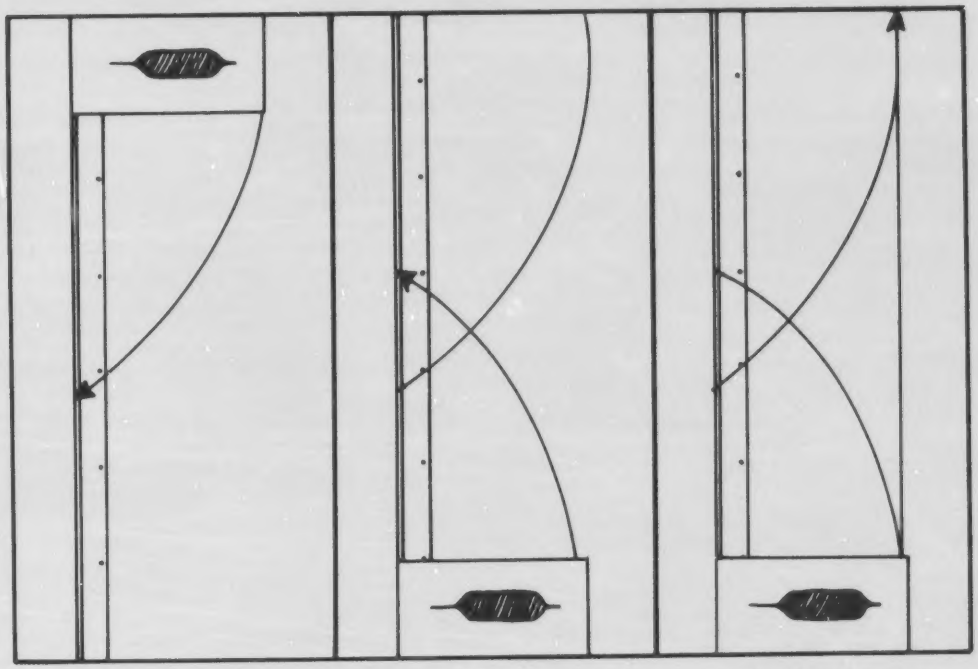
First Coat (5 Passes) on Vertical Bead

Before the first coat and between successive coats, remove any bumps, ridges, or other irregularities either by scraping with a blade or by rough sanding.

1. Start loading at the top of the bead or as high as you can comfortably reach. Pull

the blade down in one motion using the finishing edge of the bead as a guide. The filler should be 3 cm to 5 cm narrower than the blade width. The total filler width for the first coat should not be more than 25 cm. Arc off the pass at a point about halfway between where you started and the floor (Figure 5-8).

2. Load the bead from the floor up with a similar stroke (Figure 5-8). Remember all bead should be filled right to the floor.
3. Feather the edge starting from either the top or bottom (Figure 5-8).



1. Load the top 2. Load the bottom 3. Feather the edge

Figure 5-8
Loading Vertical Bead

4. Remove the excess filler starting at the bottom of the bead with a few short strokes, then stroking straight upwards to the top of the fill. Remember that to properly fill any bead the blade must move parallel to the bead edge when removing the excess.

   If the full length of bead cannot be done from the floor and stilts must be used for the tops, feather the top edge of the filler where the bottom pass stops so that there is no edge to fill against when the tops are done. In this way the tops can be feathered into the bottom filler without leaving an edge or hollow and a potential crack.

   The reason for pulling from the bottom to remove the excess is that more filler is left on the bead because the excess filler stays on the blade and gravity pulls it

into the hollow spots. If the blade were pulled down, gravity would pull the excess filler ahead of the blade, making it impossible for the excess to fill the hollow spots (Figure 5-9). Pulling up from the floor also reduces the chance of the filler falling on the floor. In addition, it is physically easier to pull the trowel up the bead.

Note that pass three, feathering, and four, removing the excess, can be combined into a single pass by some finishers who have the skill and experience.

5. Clean off the finishing edge of the bead.

If after a bead has had a first coat and there are lines in the filler that give the appearance of a wood-grain effect, it means that the bead is hollow. This is caused by making too many passes with the blade in an attempt to leave a smooth finished surface. Each pass removes filler until the fill becomes hollow. To remedy the hollow, reload the bead as if it had not been filled in the first place cutting down on the number of passes this time.

Small air bubbles in the first coat are no cause for concern as they probably indicate that there is a deep fill. But air bubbles should not be seen in the second coat or the polish coat.

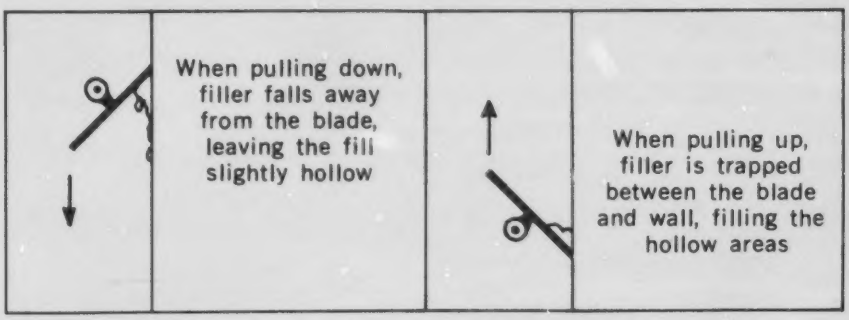

When pulling down, filler falls away from the blade, leaving the fill slightly hollow
When pulling up, filler is trapped between the blade and wall, filling the hollow areas

Figure 5-9
Pull up to Remove the Excess

Second and Third Coats on Vertical Bead

Successive coats on bead should cover the preceding coat with the last coat being approximately 30 cm wide. For the second coat use the same five passes as the first coat. The second coat is also considered a loading coat because it must fill in the shrinkage from the first coat. Because it fills, the second coat may leave small pinholes and a surface that is smooth but not polished. The third coat again uses the same passes except that the feathering and the removing the excess passes can be combined by most finishers because the filler is mixed thinner and a smaller amount is used. The finishing or polishing coat of filler should be free from lumps or foreign material. Almost all the filler that is trowelled on during this coat should be taken off to leave a light skim coat. The purpose of the finishing coat is to make the surface a final product, smooth and free from defects. The smoother the polish coat the less finish sanding will be required.

Filling Horizontal Bead

Horizontal bead such as is found on a droped ceiling is filled in basically the same way as is vertical bead:

1. Load the entire section of horizontal bead with a series of passes that arc off at the finishing edge. The length of the passes will depend on the amount of filler on the trowel and on the restrictions to the finisher's movement. Whenever possible it is best to load the full length of the bead before proceding with the other passes.
2. Feather the edge.
3. Remove the excess.
4. Clean the finishing edge or fill the other side of the bead and then clean the edge.

The second and third coats are applied using these same passes.

Filling Narrow, Parallel Beads

The valley between narrow, parallel beads 60 cm or less apart should be completely filled because the hollowness is accentuated by T-bar moldings, baseboards and tile floorings. Use a trowel or any available straight edge to load the filler from one bead to the other. The fill should be level with the finishing edges of the two beads. When a blade or straight edge that will span the two beads is not available:

Figure 5-10
Loading Parallel Bead

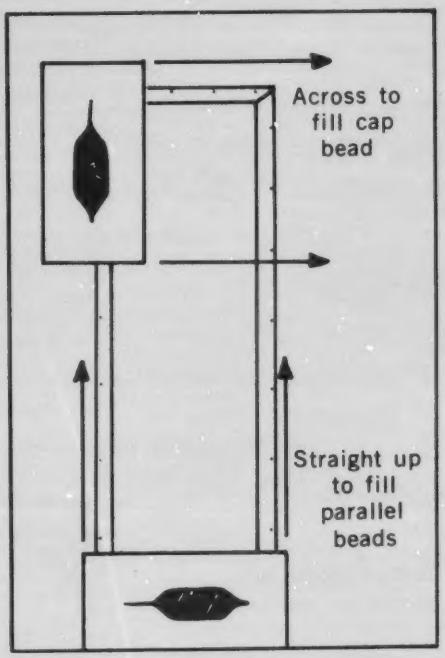


Figure 5-11
Loading a Parallel Bead Less than Trowel Width

1. Load one side.
2. Load the other side so that the filler overlaps the edge of the first side (Figure 5-10).
3. Remove the excess filler by pulling the blade up the first side using the finishing edge of the bead as a support for the blade. Next pull the blade up the other side while holding the end of it slightly above the level of the filler to feather the join. This should leave a slight ridge in the centre.
4. If you wish, you may pull a knife down the ridge to flatten the fill. Note that with slow-set filler a slight build-up in the centre is acceptable as long as you realize that it will have to be sanded flat. If fast-set is used, however, the fill should be level or slightly hollow.
5. Clean the finishing edges of the beads.

For parallel beads less than the width of the trowel blade:

1. Load the valley, contacting both bead finishing edges with the blade.
2. Remove the excess again contacting both edges. Be careful not to apply too much pressure to the blade because it will bend in the middle and leave the bead hollow.

In the case where two parallel beads are capped with a smaller piece of bead at the top, most finishers will fill the vertical bead but won't bother to fill the cap bead, thinking that it is adequately filled by the vertical bead fill. However, this reasoning is wrong. When the cap bead is not filled a hollow spot parallel to it results. By filling parallel to the capping bead there will be no hollow spot and its fill will blend into the rest of the fill (Figure 5-11). Remember that to properly fill any bead it must be filled parallel to its finishing edge.

Filling Intersecting Beads

Bead Intersecting on Outside Corners

There are two methods of filling beads that intersect at 90° outside corners.

Method One

1. Load the horizontal and vertical intersecting beads in either order. Go through the intersection on both passes.
2. Feather the edges of each bead.
3. Remove the excess from one bead, then from the other as soon as possible. Go through the intersection on both passes (Figure 5-12).
4. Clean the edges, or fill the other sides of the bead and then clean the edges.

Method Two

The same as method one except that removing the excess is done in a single pass pivoting the trowel at the corner (Figure 5-13). This method is suitable if the bead has been put on so that there is a fill of only 1 mm to 2 mm. Starting on one side, run the trowel parallel to the bead until it is approximately 30 cm from the intersection. Then turn the blade on an angle so that the top end is forward. When the leading edge comes to the corner, using the trailing edge as a pivot, rotate the trowel 90° without lifting it

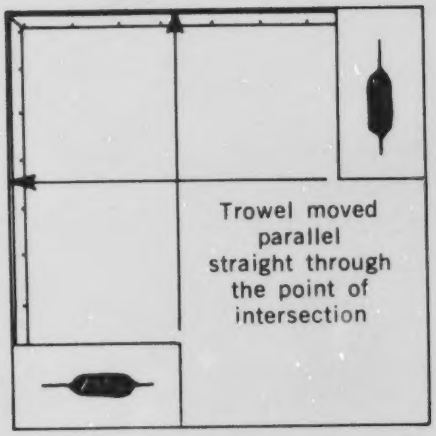


Figure 5-12
Removing the Excess from
Intersecting Bead in Two Passes

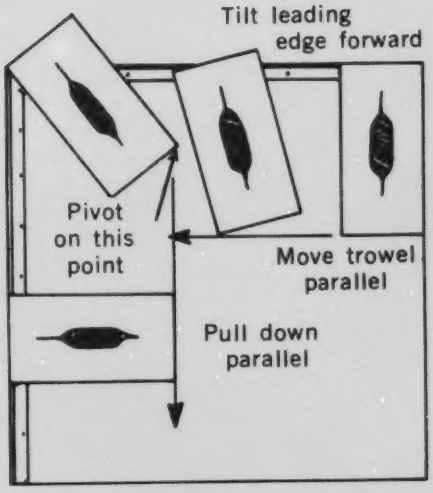


Figure 5-13
Removing the Excess from
Intersecting Bead in One Pass

from the edge of the bead and continue down the other bead. As long as the bead is tight, there will not be an overfill in the corner. Note that in this case you come down the vertical rather than up as is the general rule. This exception to the rule is necessary because it is much easier to make the pivot in a downward motion.

When filling beads that meet at an angle of less than 90° (Figure 5-14) there are two main concerns. At the intersection where the fill spans both beads, make the fill level with the finishing edges of the intersecting beads. Also, make a smooth transition at the area where the fill from the separate beads joins and spans both beads. Note that the beads should be on the same plane so that the fill between them will blend into the rest of the wall. If the beads are not on the same plane then the low side at the corner will have to be built-up or "floated" and the board filled between the two beads farther back than just where the blade spans the beads.

Intersecting Beads With One Low Edge

When the corners of intersecting beads do not meet flush, the low side of the corner must be built up with filler. Build up the low side by using the high edge as a guide for the blade to float the low side (Figure 5-15). Filler that rolls over the low edge should be sliced off to form a square edge. It is not of great importance that the surface of the filler be very smooth, in fact, the depth of the fill will make it impossible. Successive coats and sanding will produce a smooth finish. The built-up filler on the low edge should be level with the high edge giving a square corner. Shape the corner square with sandpaper.

Bead Intersecting On Inside Corners

Bead intersects on inside corners, for example, around window openings and archways.

1. Load the outside of the bead all around the opening.

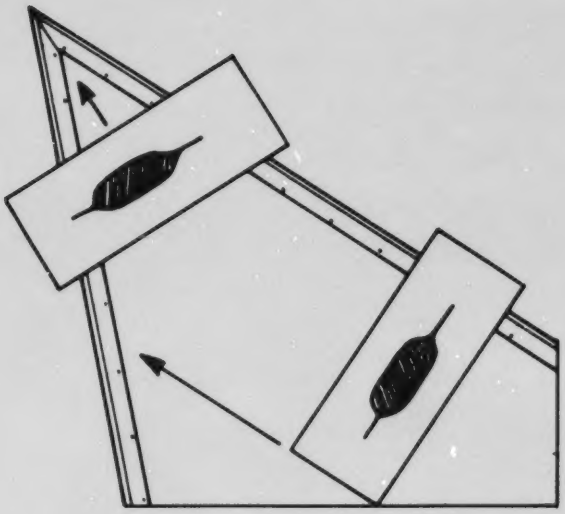


Figure 5-14
Filling Bead Which Intersects at Less than 90°

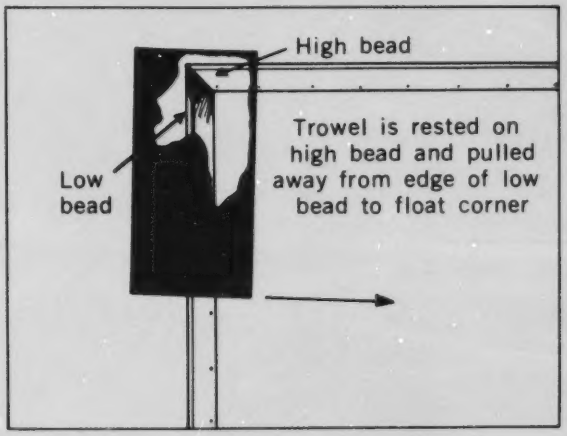


Figure 5-15
Filling Intersecting Bead that has a Low Edge

2. Feather the edges around the opening.
3. In removing the excess from an archway or window opening the object is to lift the blade from the bead as few times as possible. This eliminates ridges that are the result of joining wet filler. If you can position yourself to comfortably do so, remove the excess filler in one motion, starting at the bottom on one side and ending at the bottom on the other side (Figure 5-16) or, where bead completely surrounds the opening, at the same place you started (Figure 5-16). When you reach a corner, use it as a pivot point and turn the outer edge of the blade to leave a rounded edge.
4. Clean the finishing edges.

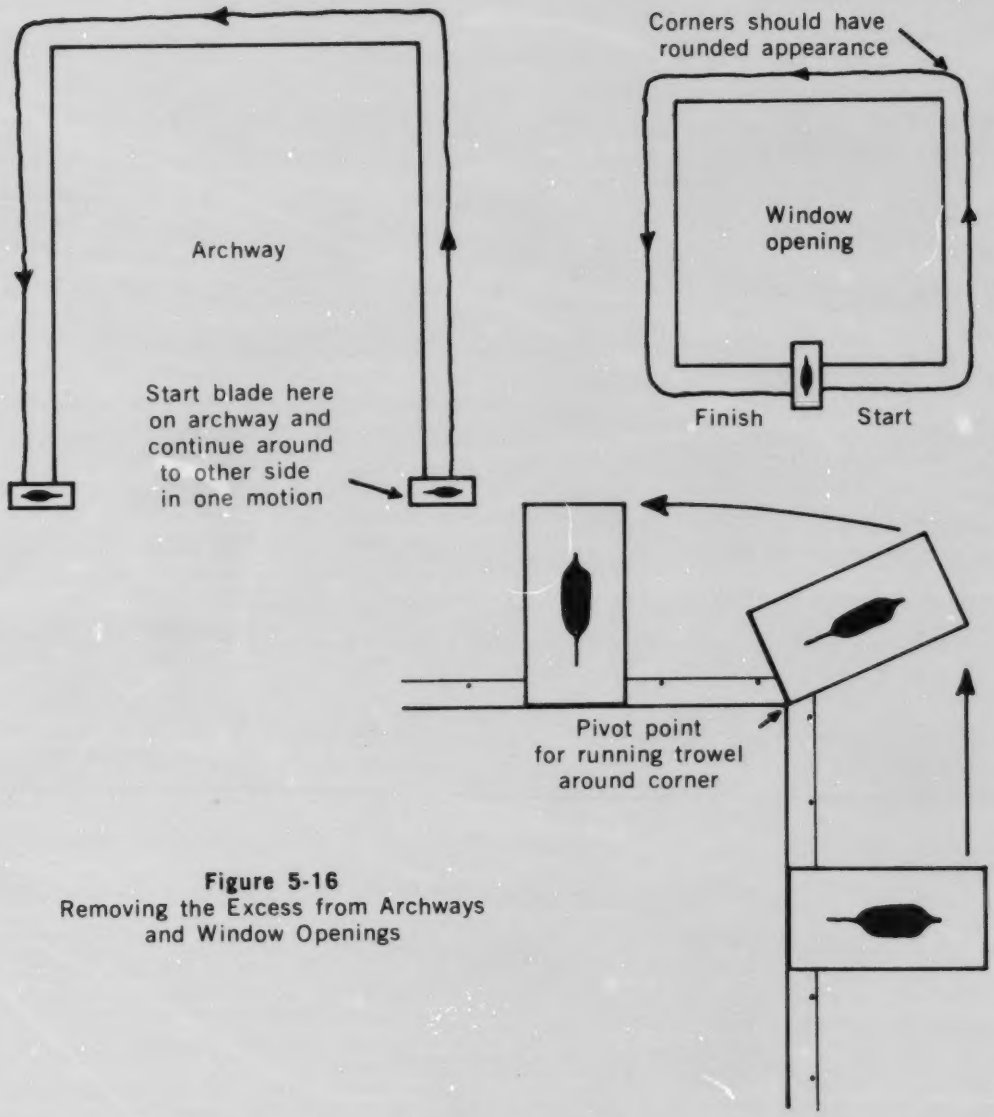

Archway
Start blade here on archway and continue around to other side in one motion
Corners should have rounded appearance
Window opening
Finish
Start
Pivot point for running trowel around corner

Figure 5-16
Removing the Excess from Archways and Window Openings

Filling Butt Joints

Because butt joints are not bevelled, the tape sits above the level of the surrounding board. To make the wall look flat and smooth, the joint has to be made wide enough to reduce the sudden change in height. Naturally, the wider the joint is filled the flatter it will look. The width that seems to be most pleasing to the eye, as well as levelling the joint, is between 60 cm and 75 cm. This width gives maximum hiding with minimum filling. Butt joints on walls are assumed here to be vertical.

First Coat on Butt Joints

Before the first coat and between successive coats, remove bumps, ridges, or other irregularities either by scraping with a blade or by rough sanding.

The first coat on a butt joint should be one blade width (25 cm) centred on the tape. Four passes are necessary:

1. Make one loading pass up the centre of the tape.
2. Feather the edge on one side.
3. Feather the edge on the other side.
4. Another pass up the centre to remove the excess and flatten the fill.

The last pass may leave two thin lines, one on either side of the centre. The higher the tape the more filler is required to load it and thus the more prominent are the lines. These lines are acceptable as they can be reference points for the second coat. The first coat on the joint should fill the tape with just enough mud to cover it. The tape should be visible, but should not appear dry. This is the highest the joint will be as the tape is covered by only one more skim coat to polish it.

Second Coat on Butts

Rough sand between coats.

The second coat on butt joints requires four passes on each side of the joint for a total of eight passes. This coat should be about 60 cm wide. On each side of the butt joint:

1. Following the edge of the tape or the line left by the final pass on the first coat, make a loading pass up the joint.
2. Feather one edge of the fill.
3. Feather the other edge.
4. Make another pass up the centre to remove the excess and flatten the fill.

Note that the second coat on either side does not touch the tape.

Third Coat on Butts

If the tape is tight to the wallboard to start with, two coats will do a good job. However, a third or polish coat is often required. The polish coat is done with thin filler and a longer blade. The entire surface of the butt is covered and then skimmed off. After polish coating, the joint will be 60 to 75 cm wide and will be ready for sanding.

Note that if it is necessary to load any filler on the third coat, it means that the first and second coats have not been properly applied.

Filling Butt Joints on Curved Surfaces

Butt joints on flat surfaces are not easy to fill, but on curved surfaces they are even more difficult. It is most critical that the tape be wiped tightly to the board: the closer the tape is to the board, the less problems you will have. Filled joints on curved surfaces must maintain the curvature of the wall; they should not be flat.

First Coat on Butts on Convex Surfaces

Using a flexible knife that will bend to the curve of the wall:

1. Make a loading pass down the centre of the butt tape.
2. Feather the edges.
3. Remove the excess with a final pass down the centre of the tape. The tape should be visible through the filler. The filler should not flatten out at any section along the curve, but should always follow the curve.

Second Coat

1. Make a loading pass on each side of the tape. No filler should be put on the tape during the second coat.
2. Feather the edges.
3. Remove the excess.

Third Coat

1. Check the joint for flat spots by running your hand over the joint, or by using a light or a straight edge. If you find any flat spots, sand them out or refill them to match the curve before applying the final coat.
2. Load the entire filled area.
3. Remove most of the filler leaving only a skim coat on the surface. The width of the joint should probably be wider than a butt joint on a flat surface. This extra width helps hide the joint and maintain the curve of the wall.

First Coat on Butts on Concave Surfaces

To properly fill butt joints on a concave surface the tape must be covered. As with convex surfaces, use a wide flexible blade that will bend to the curve of the surface.

1. Make a loading pass over the tape.
2. Feather the edges.
3. Remove the excess filler. The tape should be covered to maintain the curve of the surface. Do not try to get the filler perfectly smooth.

Second Coat

1. Load filler over the joint overlapping the first coat by 2 to 5 cm on each side.
2. Feather the edges.
3. Remove the excess maintaining the curve.

Third Coat

1. Load filler over the joint.
2. Remove the excess leaving only a skim coat.

A concave butt joint finished in this manner may be only 25 to 30 cm wide, but this is not a problem. The major concern is that the filled joint maintain the curve.

Filling Flats On Curved Surfaces

A common problem with flats on curved surfaces is that the bevel can flatten out causing the tape to sit higher than the surrounding surface. In this case the joint should be filled like a butt joint. The filled flat will be 45 to 60 cm, wider than the normal flat. This is acceptable as long as the height of the joint is not greater than 2 mm in 1 m when a straight edge is placed perpendicular to the joint.

Filling Uneven Butt Joints

Butt joints are not always even and flat. On uneven butts that have not been pre-filled, establish the high and low sides. The high side will require very little filling.

First Coat on Uneven Butts

1. Load the joint so that the end of the blade runs on the high side (Figure 5-17), i.e., the loading pass will not centre on the tape but rather will be off-centre to the low side.
2. Feather one edge.
3. Feather the other edge.
4. Make a pass up the centre of the fill (not the tape) to remove the excess and flatten the fill.

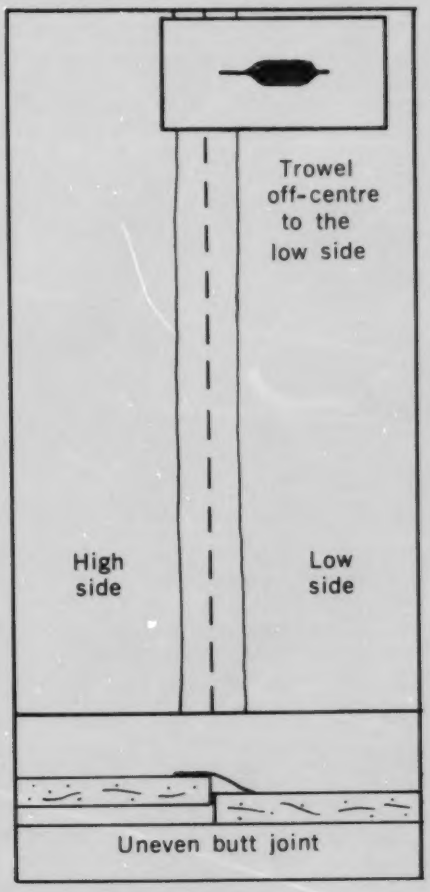


Figure 5-17
Filling Uneven Butt Joints

What the first coat on an uneven butt joint does is to move the centre of the fill for the joint to the low side. The high side only requires a small amount of filler to skim the tape so that it is covered adequately for decorating. If too much filler is left on the high side, the joint will be covered but will still be uneven.

Second and Third Coats On Uneven Butts

The second coat for uneven butts is basically the same as that for even butts. Using the lines left by the last pass on the first coat four passes are made on either side of the centre of the fill (not the centre of the tape). Note, however, that unlike with even butts, the second coat on uneven butts skims the tape because the tape is off-centre in relation to the fill.

The third or final coat will skim in the full width of the joint. Most of the filling will be on the low side so it may be necessary for the joint to be wider than 70 cm. For the joint to be acceptable, a 1250 mm straight edge, when placed on the joint, should not have more than a 2 mm gap on either side.

Filling Flats

First Coat on Flats

Before the first coat and between successive coats, remove bumps, ridges, or other irregularities either by scraping with a blade or by rough sanding.

The tape on flats should be below the surface of the surrounding board. Bumps in the tape should be cut out because likely there is a broken piece of board or some other material behind the bump. It is easier to remove bumps than to fill around them.

Flats here are assumed to be horizontal. Always fill flats right to the angle, and as close as possible to the finishing edge of the bead. This covers the area where the filler may shrink back because of the bevel in the board. Also, fill right over butt joints even if the filled butt joint covers the flat.

The first coat should be no wider than 25 cm. Filler should be applied in long strokes as far along the flat as possible; long strokes produce the best effect and also get the job done quicker. The angle of the blade should be approximately 45 degrees so that a minimum amount of filler is left.

While covering the tape, the first coat should be full and as free from defects as possible. Defects such as air pockets and scratches must be avoided as they are below the surface of the filler and cannot be sanded out. On the other hand, lumps and ridges can be sanded out if the sander conscientiously watches for them. However, leave as few defects as possible in order to make the joint continuous.

The passes made for the first coat on flats are:

1. Load the flat down the middle of the joint so that it is about 3 mm thick and about 20 cm wide. Where drying conditions permit, load the entire length of the joint before feathering.
2. Feather one edge.
3. Feather the other edge.
4. Remove the excess with a pass down the centre of the flat. Small edges on either side of the centre of the joint mean that too much filler has been left on the joint.

With powdered, slow-setting filler, it is desirable to leave a slight build-up (1-2 mm) over the centre of the joint on this pass to compensate for shrinkage. A curved blade can be used to get this build-up since more filler is left in the middle of the joint than on the edges. With pre-mix, you will have to check the shrinkage before knowing if it is necessary to leave the build-up. Some pre-mixes will need the build-up but others won't.

If after a few minutes the full width of the tape can be seen in spots, it means that uneven pressure has been applied to the blade thereby removing too much filler from the joint. The joint must be filled again, making sure the pressure on the blade is even.

When filling over any joint that has previously been filled, e.g., when filling flats over butt joints, it is important to compensate for the drying of the filler. The wallboard will absorb moisture from the previously applied filler causing the filler to have a different consistency from when first put on. As well, a film will start to form on the surface and cause the filler to tear or "pull" as the blade is passed over it. To avoid pulling, always have filler on the blade to feather over the drying filler. If necessary, leave a small edge that can be easily sanded off.

As the filler dries, if only half the width of the tape can be seen, it means that the edges of the board are uneven. To remedy this defect, you must build up the low side (the covered side) and make it wider so that the build-up will not be noticeable. Make the last stroke with the blade down the centre of the fill (not the tape) to remove the excess filler and leave a flat surface.

Second Coat On Flats

The second coat on flats is a thin polish coat about 30 cm wide. The passes are the same as for the first coat. Make sure that the loading pass is wider than that for the first coat. There is usually no third coat on flats; if tapes are wiped properly the bevel is full making it only necessary to flatten and smooth the joint, a job that can be done in two coats.

Filling Butts and Flats With Machines

The advantage of using machines for filling is the speed with which joints and angles can be filled. When the machines are set up and run properly only minor touch-up is required. Some finishers, however, insist on going over the joints with a knife or trowel to smooth the fill left by the boxes. This is a poor practice because it defeats the time saving advantage of the machine. If machine filled joints have to be completely gone over by hand, the machines are not being run properly.

Filling Machines (Boxes)

Filling machines or boxes come in three sizes — 18 cm, 25 cm, and 30 cm. The 30 cm box is used only for finishing; the 18 cm and 25 cm boxes are used for loading coats. The boxes are metal with a hinged back to which a handle is attached (Figure 5-18). The handle is used to apply pressure which causes filler to spread onto the wall. The leading edge of the box has wheels on a pivoted axle enabling the box to run easily on the wall. The wheels should be oiled at least 12 hours in advance of use so that the excess oil will run off. If you oil the wheels just before the boxes are used, oil film may be deposited on the board and cause the filler to peel off the wall.

The trailing edge of the box has an adjustable finishing blade fixed on a sectioned brass bar. The blade should have a bow in it so that slightly more filler is left in the centre of the fill than on the edges. Just above the bar is a semi-circular cam that puts pressure on the bar to regulate the amount of filler being dispensed. It is important that the joints be lightly sanded before filling to prevent the finishing blade from picking up any dry material and causing scratches.

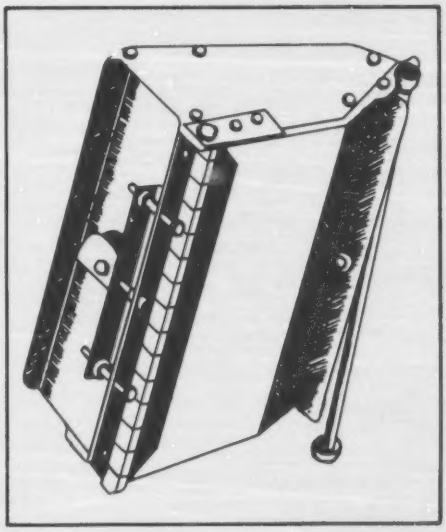


Figure 5-18
Filling Box

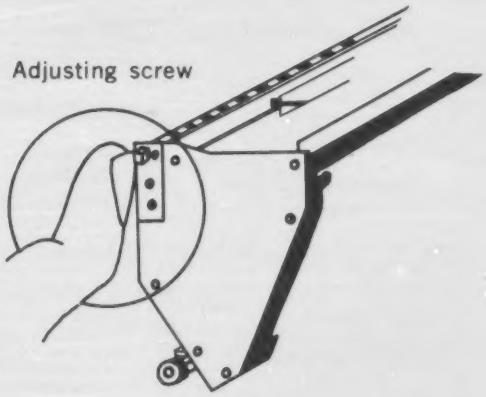


Figure 5-19
Blade Adjusting Screw

Before using the boxes soak them in water to soften any material inside. The handle is attached to the box by sliding the bolts on the back of the box into the notches of the handle and tightening the wing nuts. The brake lever should be tested and adjusted to the liking of the operator. This is done by adjusting the set screw that contacts the finned brake plate on the handle. The blade, when correctly adjusted, should be slightly above the shoe at the end of the box. If the blade is too high it will remove too much filler and could cut into the board; if it is too low it will not feather the edges. To test the height of the blade, pull your finger nail across the blade at a point near the end of the box. Your fingernail should just catch the blade. To make adjustments turn the screws at the ends of the blade ((Figure 5-19). Push down on the end of the blade to make sure it is tight against the screw and that it is properly adjusted. The screw should turn easily so that any piece of flat metal will turn it if a screwdriver is not handy. While checking the blade height, also make sure the blade is free from nicks and burrs and that the edge of the blade is square. If you find that a blade will not feather properly and cannot be adjusted to do so, replace it with a new one.

To adjust the amount of filler dispensed by the box, adjust the cam above the blade. The higher the cam number, the more pressure is applied on the bar and the less filler is left on the joint.

As when filling with hawk and trowel, shrinkage in the filler must be taken into consideration when using boxes. There are three distinct methods of filling when using shrinking, non-shrinking, and expanding fillers. The filler must be built up for shrinking filler, left level for non-shrinking filler, and left hollow for expanding filler. Boxes should be adjusted so that the right amount of filler is left on the joint according to the type of filler used. It may also be necessary to adjust the boxes for variations in joints.

Loading Filling Boxes

A pump is used to load boxes with filler. The pump must be clean on the inside and have a screen on the intake to prevent hard material from getting into the box and causing scratches in the filler. The filler must be thin enough to pump. A flat nozzle attached to the pump by a chain is needed to fill the boxes (Figure 5-20). It is put into the outlet by wetting the rubber ring and then pushing the nozzle into place with a slight turning motion. The nozzle should easily fit into the hole; do not try to force it by hammering it.

Filler is pumped until it can be seen at the mouth of the box. Do not let the filler run out of the mouth as it will make the box messy and leave unwanted filler on the wall. The cleaner the box is kept the cleaner the job will be. The first time the box is filled after it has soaked in water, it should be emptied back into the pail. This will remove all the water the filler has picked up from inside the box. If this first boxful is applied to the wall it will run off the joint because it is too thin to stay in place.

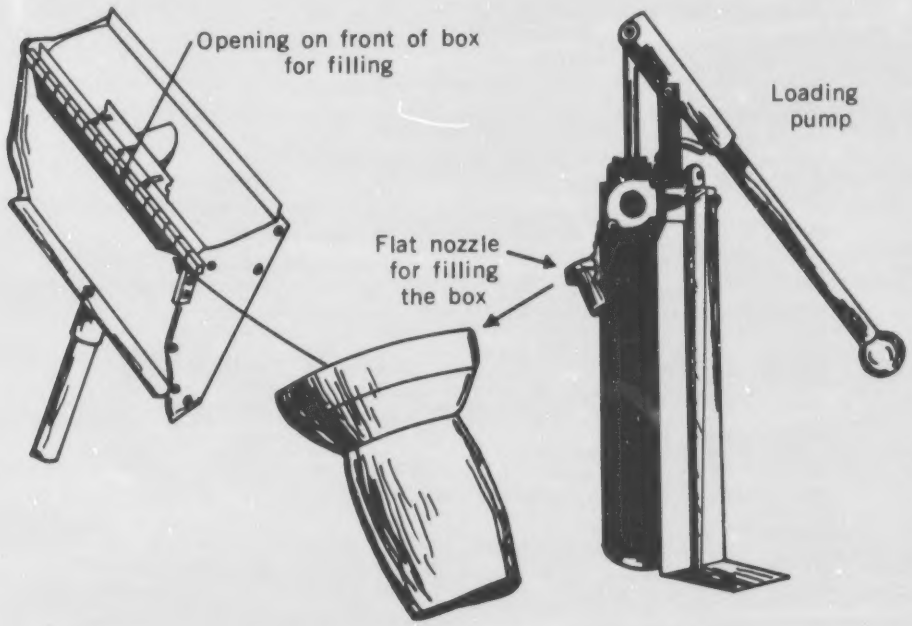


Figure 5-20
Filling a Box

Filling Box Combinations

Before the first coat and between successive coats, remove bumps, ridges, or other irregularities either by scraping with a blade or by rough sanding. This is necessary to prevent the finishing blade from picking up any dry material and causing scratches.

There are three combinations of boxes used for flats and butts in the trade. One combination is:

1. First coat, 18 cm box.
2. Second coat, 25 cm box.
3. Third coat, 30 cm box.

This combination is used when a very good finish is required.

Another combination is:

1. First coat, 18 cm box.
2. Second coat, 25 cm box.

This combination is preferred by some finishers as a way of saving filler. However, the finished width of 25 cm is not aesthetically pleasing to the eye.

The most popular combination is:

1. First coat, 25 cm box.
2. Second coat, 30 cm box.

This combination is accepted as a standard in the trade; it gives a satisfactory width for decoration.

Filling Flats With Boxes

The first coat is done in one pass with the box, and some touching up with a knife. Place the box on the flat as close as possible to the angle (Figure 5-21). Hold one hand just below the head of the box on the handle, and the other hand at the end of the handle to operate the brake. Boxes may be operated equally well left or right handed. The hand nearest the box applies the pressure to force the filler out of the box. The elbow of that arm is braced against the body so that the arm forms a 90° angle to the wall. The other hand keeps the box running parallel to the joint. Thus the blade of the box is perpendicular to the joint leaving the filler even and feathered on both edges. The filler should be of a consistency that it will not run out of the box when turned sideways, yet will not need a great deal of pressure to force it out.

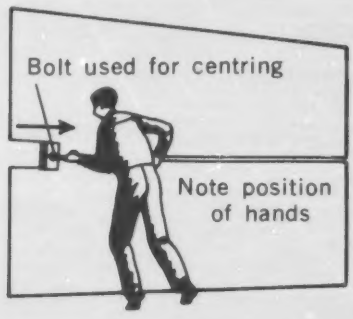


Figure 5-21
Filling a Flat with a Filling Box

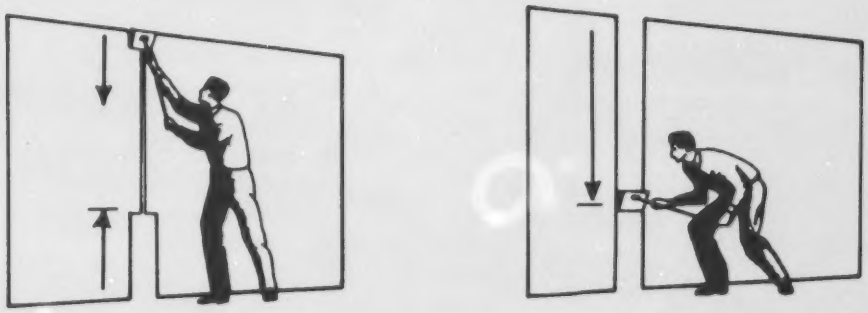
When starting a flat, do not apply pressure too soon before moving the box, since too much filler will leave the box and cause a run. The pressure and the moving of the box along the joint should be almost simultaneous. As the box is pulled along the flat the bolt that holds the axle to the box can be used to centre it on the joint. By keeping the bolt in the centre of the tape the box will dispense filler evenly on each side of the joint. Toward the end of the pass on the flat apply the brake and gradually lift the box from the wall in a sweeping motion. This will feather out the filler and not leave a ridge. Use a knife to touch up the flat and both ends of the flat to leave a smooth surface. If scratches appear in the filler, wipe the box blade and check the joint for hard material, then run the joint again until the filler is free from scratches.

When running flats that intersect butt joints, the amount of touch-up needed owing to the wheels having run through the wet filler can be minimized. Lift the wheel that touches the filler by applying the brake and slightly lifting one corner of the box. With practice, little or no touch-up will be required.

When the 30 cm box is run to finish the flats, the filler is thinner and the setting on the box is normally one higher than that on the 25 cm box. This should leave a very smooth, polished surface asssuming that the first coat on the flats is free from lumps and scratches. The finishing coat should go on much faster than the first coat.

To run vertical flats the box must be more than half full. If the joint is 120 cm long, the box can be run the length of the joint without lifting it off the wall. If the joint is the full height of the wall it is necessary to run two passes. The first pass on the full length joint is from the bottom (Figure 5-22). With the brake on, brace the handle against your leg to put pressure on the box so that the filler flows onto the wall. By having your legs bent and then straightening them, you will be able to lift the box up the wall high enough without unduly straining your back. The bottom pass should end at least 60 cm up from the floor so that the pass from the top of the joint will not cause you to bend your back.

To run the upper part of the joint, place the box as close as possible to the ceiling. It may be necessary to gently bang the box against the top of the joint so that the filler



1. 2.

Figure 5-22
Filling a Full Length Vertical Flat
with a Filling Box

will be forced out. With the brake on, pull the box down the joint until pressure keeps the wheels from lifting off the wall, then release the brake. The box will be approximately 60 cm from the ceiling when the brake can be released.

Filling Butts With Boxes

If wall butt joints are fairly level, they can be run with a box, but if they are uneven they should be done by hand. The exception to this is butts on ceilings that are to be textured. These are run level or not when boxes are used. There are three methods for running butt joints by machine:

Method 1

Coat 1

1. With a 25 cm box run each side of the joint with the edge of the box on the centre of the tape.
2. While the filler is still wet, take a knife and skim in any exposed tape.

Coat 2

1. Same as coat 1 with a 30 cm box.

Method 2

Coat 1

1. Run down the centre of the tape with an 18 cm or 25 cm box. The tape should be just visible through the filler.

Coat 2

1. With a 25 cm box run each side of the tape (not over the tape).

Coat 3

1. Repeat coat 2 with a 30 cm box.

Method 3

This method is for ceilings or other surfaces that will be textured and where there is not the concern for a perfectly smooth joint.

Coat 1

1. Run a 25 cm box down the centre of the tape.

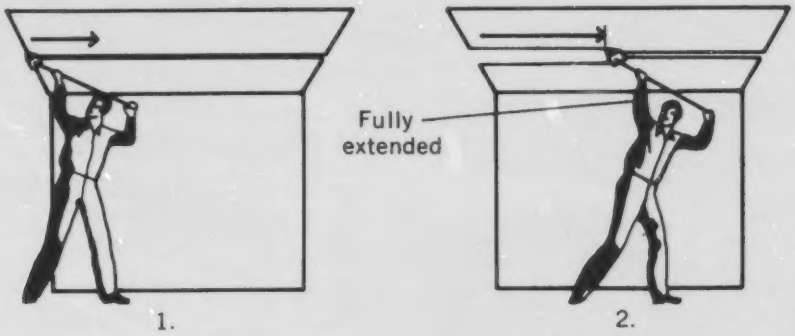
Coat 2

1. Run a 30 cm box down both sides of the tape (not over the tape).

Filling Ceilings With Boxes

When running the box on the ceiling, adjust the sliding grip on the handle so that the arm of the hand nearest the box is fully extended and braced against the grip (Figure 5-23). This arm acts as a fulcrum for applying pressure with the other arm. Put pressure

on the box by pulling down on the end of the handle. This feels as if you are gently wedged between the floor and ceiling. The filler should not be so stiff that it will cause discomfort to your shoulder joint when pressure is applied to force the filler out of the box. (Refer to Module Two for a detailed description of body stress.)



Note the position of the arms

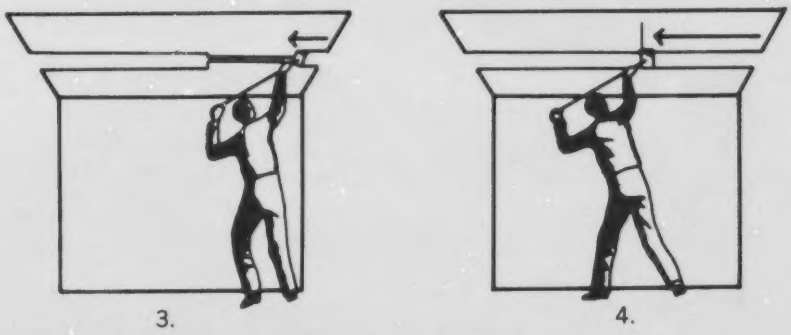


Figure 5-23
Filling a Ceiling Flat with a Filling Box

Filling Fasteners By Hand

The filling of fasteners requires a great deal of attention. It is sometimes overlooked as being unimportant since it is usually the first thing an apprentice is taught. Because many fasteners are needed to hold the board securely in place, there is a high possibility that improper filling will be seen. Generally, three coats of filler are necessary to fill depressions around fasteners so that they are flush with the level of the surrounding board (Figure 5-24).

At no time should it be necessary to build up with filler around a fastener to cover it; the head of the fastener should always be below the surface of the board before the area is filled. This ensures that the board is tightly held to the framing member, as well as making the fastener easy to fill.

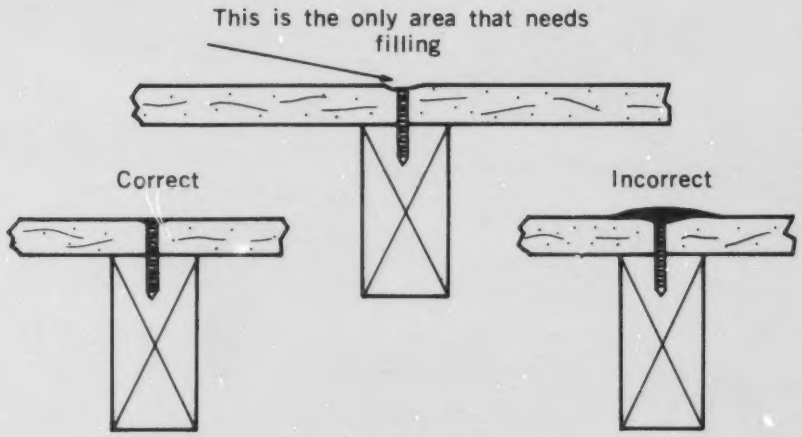


Figure 5-24
Filling Fasteners

A hammer and Phillips screwdriver should be part of a finisher's equipment. Any nails that protrude should be hammered in, and any screws that stick out should be countersunk. Never hammer a screw as it will loose its holding power.

Also, all loose paper and dry filler in the area around the fastener must be removed to produce a smooth, flat surface.

Only a skim coat of filler should be on the board surrounding the fastener. If this is not done and more filler is left on the board to build up the fastener, the depression around the fastener will be accentuated by uneven shrinkage. Because it is thicker than the filler on the board, the filler in the depression will shrink more. In this case the fault lies with the way the filler is applied, not with the composition of the filler.

Each coat of filler should overlap the edges of the preceding coat so that when three coats are applied there is a circle of filler of approximately 15 cm diameter around nails and 10 cm diameter around screws. Edges on filler around fasteners are hard to sand because they need a lot of care to avoid tearing the surrounding paper. By overlapping the coats, the likelihood of leaving edges is considerably reduced. Overlapping of the coats is easily accomplished by using three sizes of knives for the three coats. The first coat on the fasteners is done with a 10 cm knife and should cover only the depression around the fastener to make it level with the surrounding surface. The second coat is done with a 13 cm knife, and the third with a 15 cm or 18 cm knife. By progressively using wider knives, more filler can be held on the knife, thus leaving a progressively larger circle. Although it is easier to use different size knives for the first and second coats, it is possible to use only one knife to do both coats by regulating the amount of filler on the knife.

The filling around screws will be smaller than around nails because nails have larger depressions around them. The least possible amount of filler should be used to level the surface. The angle of the knife will determine the amount of filler left on the surface. For a flexible knife, the angle of the handle to the wall should be very close to 90°. More pressure on the blade will also leave less filler. Stiffer knives will need less angle and pressure.

Fasteners can be filled singly or by row. Nails with deep depressions are filled singly, whereas screws and nails with moderate depressions can be filled by row. Filling by row is usually the faster method.

Filling Nails Singly

It will take practice to determine the right amount of filler needed on the blade so that filler does not run out from the edges of the knife. Quite a few nails can be done with one knife of mud; the knife should not have to be wiped off or have more filler added to it after each nail. However, when polish coating the nails (and screws), the filler should be changed when it becomes too stiff to manage.

Coat 1

1. Run the blade sideways up and over the nail to load.
2. Run the blade, in normal position, down and over the nail to remove the excess.

Coat 2

1. Coat 2 is the same as coat 1 except that it is applied in the opposite direction, i.e., since coat 1 is vertical, coat 2 is horizontal. Changing the direction between coats is important because if you don't there tends to be a hollow at the top end of the depression.

Coat 3

1. Vertical fill as in coat 1.

Filling Fasteners By Row

Coat 1

1. One pass up (or across) the row to load (Figure 5-25).

Figure 5-25
Filling Fasteners by Row

2. One pass back the opposite way to remove the excess. Take care to make sure that the fastener heads are completely covered and that there is no build-up of filler on the surface of the board between the fasteners.

Coats 2 and 3

1. Same passes as coat 1. Coat 1 should cover coat 2, and similarily coat 2 should cover coat 3.

When filling fasteners on a curved wall, it is critical to keep the curve of the surface. Thus the direction of the passes will be horizontal rather than vertical.

An exception to the two passes per coat for fasteners occurs when holes are being filled after fasteners are removed when the board is laminated, or when fasteners are removed because studs are missed. A third stroke over the hole is needed to remove the little bubble of filler that remains in the centre of the hole. This third pass eliminates scraping between coats to make the depression flush with the wall.

Paper protruding from the surface where a fastener has been driven in and then pulled back out must be specially treated. Pull out the loose paper, force filler into the hole and under the paper, gently press the bulging paper back into the hole with the knife handle to embed the paper into the filler, then refill the hole and wipe the excess. This prevents the paper from protruding through successive coats of filler as it will if you only pound in the paper with the end of the knife. Paper protruding as the result of a crack in the board where the fastener has been driven in too far should be torn off and the crack taped to prevent it from showing after the final decoration. In this case a larger area must be filled to make the surface level and flat.

Filling Machines For Fasteners

A fastener spotter is a machine for filling fasteners (Figure 5-26).

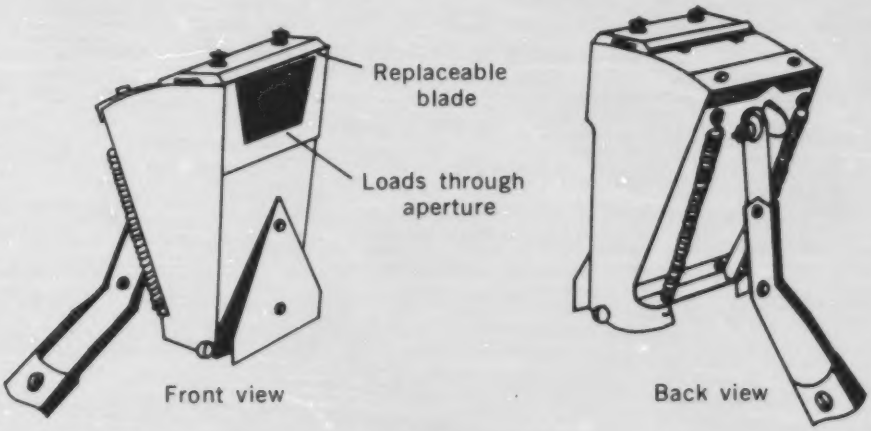


Figure 5-26
Fastener Spotter

A spotter is a metal box of either 5 cm or 8 cm width equipped with a blade to remove excess filler from the area surrounding the fastener. A long handle is hinged to the back of the box. These boxes speed the process considerably as a row of fasteners can be coated in one stroke and ceilings can be done without using stilts. However, spotters need more clean-up time than knives. They also need a good boarding job because fasteners that protrude above the surface of the board will chip the blade, which takes time to replace. Thinner filler is needed than when filling fasteners with a knife and pan because the filler must be pumped into the box and then squeezed out onto the wall. Spotters are filled in the same way as are the boxes used for filling flats. They work best when used to fill screws rather than nails because screws need less filler.

Filling Fasteners With A Box

To fill fasteners with a box:

Coat 1

1. One pass with the 5 cm box over the row of fasteners.

Coat 2

1. For textured surfaces a final pass with the 8 cm box.
2. For smooth surfaces another pass with the 5 cm box.

Coat 3

1. Textured surfaces do not require a third coat.
2. For smooth surfaces a final pass with the 8 cm box.

Before using a spotter check the blade to make sure it sticks above the surface of the box just high enough so that your finger nail will catch on it when you pull it across the blade. Place the spotter on the surface and push the handle to force the filler out to the blade. Then pull the spotter down over the row of fasteners. When the end of the row is reached, release pressure from the handle and "roll" the spotter off the wall (Figure 5-27). It may be necessary to wipe off a little ripple of filler at the end of the row.

Only a little pressure is needed to force the filler out of the box. If you push too hard while the box is not moving, filler may be forced out beside the box and need wiping with a knife. The box should be moving when pressure is applied. Spotters are held in the same way as the boxes for flats and butts.

Figure 5-27
Correct Procedure for Removing a Fastener Spotter from a Surface

When scratches appear in the filler, check the blade for grit and redo the fastener. Keep the trailing edge of the blade free from excess filler to ensure a smooth feathered edge. The cleaner the box is kept during the filling process the cleaner the job will be.

Filling Angles

Angles can be filled either by hand or machine. Only one side of an angle at a time is usually done by hand, whereas a machine can fill both sides at once. Filling by hand leaves a better feathered edge, takes less filler, and compensates for angles that are not 90°. Machine-finishing requires good framing. It leaves a more uniform looking finish and is more economical for most jobs because it is quicker.

Filling Angles By Hand

To fill angles by hand, use a knife at least 10 cm wide because the width of a sander is 8 cm. The finished width of the filler on one side should be slightly more than 10 cm so that the sander will not tear the paper.

The two sides of an angle are not usually filled at the same time. One side is filled and let dry, then the other side is done. Sides of angles in a room are filled in a sequence so that wet filler does not have to be blended into wet filler. This sequence for a room with four corners and no textured ceiling is as follows:

Note that this sequence is for right-handed people who generally work from left to right. A left-handed person would work in the opposite direction from that given here.

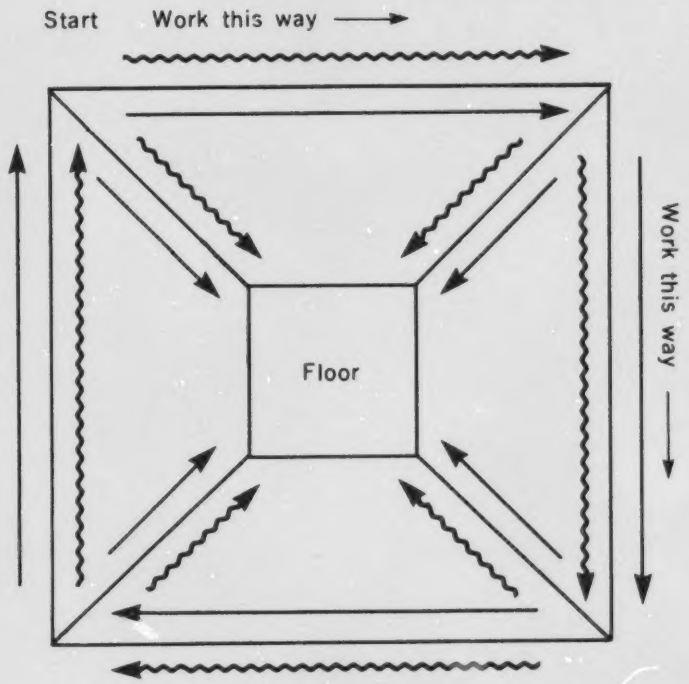


Figure 5-28
Sequence for Hand Filling the Two Sides of Angles in a Room

First Sides of Angles (Solid lines on Figure 5-28)

1. Left side vertical angle, wall angle to second threeway.
2. Right side vertical angle, ceiling angle to third threeway.
3. Left side vertical angle, wall angle to fourth threeway.
4. Right side vertical angle, ceiling angle back to starting threeway.

Second Sides of Angles (Wiggly lines on Figure 5-28)

1. Right side vertical angle, ceiling angle to second threeway.
2. Left side vertical angle, wall angle to third threeway.
3. Right side vertical angle, ceiling angle to fourth threeway.
4. Left side vertical angle, wall angle back to starting threeway.

If a ceiling is to be textured, only the wall angle has to be filled. However, the ceiling angle should be checked for edges and fasteners that need filling.

Filling both sides of an angle at the same time by hand takes practice and a steady hand to ensure that filler on the opposite side is not gouged out. This is possible on small jobs with few angles but not practical for large jobs.

Note that some finishers prefer to fill the top angles by hand and the vertical ones by machine. This leaves a wider fill on the top angle which is easier to sand. With this system the top angles are filled when second coating and the vertical angles on the third coat.

First Coat On Angles

Before the first coat and between successive coats, remove bumps, ridges, or other irregularities either by scraping with a blade or by rough sanding.

1. Depending on the drying conditions, load the entire length of one side of the angle. On vertical angles the filler should be tight to the bottom of the angle and to the ceiling, and on horizontal angles tight to the wall at either end. A maximum of 1 mm of filler should be applied, enough to just cover the tape. More than 1 mm will leave air bubbles in the filler and likely cause the corner to crack from a build-up of filler.
2. Ideally, one pass of the knife should feather the edge, smooth the filler, and clean off the excess filler from the other side of the angle. However, if you can't do it in one pass, do it in two: one to feather, a second to smooth and to remove the excess from the other side.
3. When the first sides of the angles are dry repeat the same procedures for the second sides of the angles. Note, gouging and tearing of the filler are signs that the first sides are not dry.

Second and Third Coats

There are no second and third coats on angles for two reasons:

1. The narrow width of tape does not require a wide fill to blend it into the wall.
2. A second coat can build up in the angle and cause hairline cracking in the filler.

Filling Angles With Machines

Angle machines or boxes are available for filling angles (Figure 5-29). They come in three sizes: small, medium and large. The medium box is more awkward to handle than the small one but it holds more filler. The large box holds the most filler but it is difficult to handle, particularly in closets. Each box has a cone-shaped spout upon which is attached the flusher head that contacts the angle.

Flusher heads are made in 5 cm and 8 cm widths. The 8 cm flusher provides a good feathered angle that is easy to sand. Its most practical use is on angles that are 90° or close to 90°. Using it on angles that are not close to 90° will result in an edge that will require feathering with a knife. The 5 cm flusher is frequently used by finishers but it does not feather out past the taping filler enough to make sanding easy, nor does it always leave enough filler to properly coat the tape. Its best use is when angles are not a perfect 90°. New flusher blades may have a very sharp corner that cuts the angle if too much pressure is applied. If you are near a distributor the flusher head should be sent back for adjustment. If not, file the point of the blade to round it off slightly. Check the guide for wear at the leading end of the flusher so that rough edges do not occur and tear the tape.

Before filling, angle boxes with the flusher head in place should be soaked in water to soften any dry filler. The angle box is filled by placing the filler valve into the outlet of the pump. The filler valve is just below the cone-shaped spout and has a spring loaded valve to prevent filler from coming out when the angles are being run. The box should be filled until the filler appears at the flusher outlet. The first boxful of filler should be emptied back into the pail because the filler will pick up any water in the box and be too thin to use. Count the number of pumpings it takes to fill the box without squirting filler all over the flusher, the floor, and yourself. Remember, the cleaner the machine the cleaner the job.

Most drywall finishing companies use three people when filling angles with an angle box: one runs the box, one touches up the bottoms, and the other wipes the threeways. The speed with which the angles can be done compensates for the cost of the extra help.

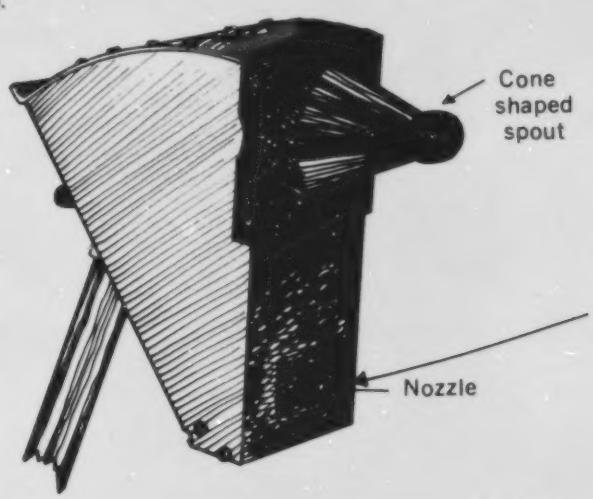


Figure 5-29
Filling Box for Angles

Using Angle Boxes

Some points when using angle boxes:

If scratches appear when running an angle box, check the blade for dry material. Also, keep the back edge of the flusher blade clean to avoid runs in the filler. Never run a flusher head when the blade will come in contact with a metal bead edge (e.g., closet opening) or concrete surface.

Vertical Angles

Filling angles with boxes requires one coat, the same as by hand. Before running the box on the angles, remove bumps, ridges, or other irregularities either by scraping with a blade or by rough sanding. This prevents the finishing blade from picking up any dry material that cause scratches.

1. The first pass on a vertical angle should be from the bottom up to a point (about 45 cm to 60 cm from the floor) that allows easy blending with the second pass. Brace the handle against your leg (Figure 5-30) to provide enough pressure to force the filler out, and bend your legs so that when they are straightened the box will be lifted up the angle without putting strain on your back.
2. The second pass is made from the top of the angle down and blended with the first pass. Note: with practice it is possible to eliminate the short pass in point 1, and run the angle top to bottom in one pass.
3. Run the angle as many times as needed to get a smooth angle with a feathered edge. However, with some angles, no matter how many times you run them, you won't be able to get a smooth finish. Indications of angles that can't be done by machine are air pockets in the surface because of deep fills in the angle, an edge that won't feather, and jamming of the flusher in the angle. These angles must be filled by hand.

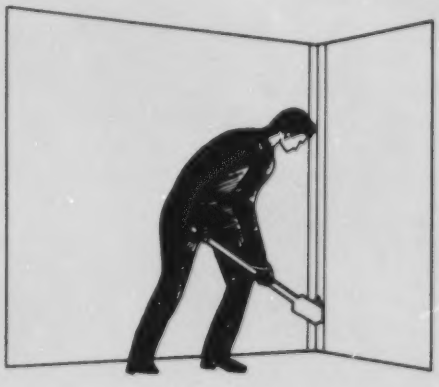


Figure 5-30
Handle of Box Braced Against the Leg

Horizontal Angles

1. Horizontal angles should be run in one motion without stopping to prevent the formation of ridges that require touching up. The pass should be as close as possible to the threeway at either end.

2. Run the angle as many times as needed to get a smooth angle with a feathered edge.
3. Note that horizontal angles in closets should be done before the vertical angles so that any filler that falls into the vertical angle can be picked up by the flusher.

Filling Bottoms and Threeways

The person filling the bottoms is responsible for any edges and other irregularities in angles up to the 120 cm mark. The person filling the threeways is responsible for irregularities in angles (vertical and horizontal) above the 120 cm mark. It is important to remove any edges and fill any scratches while the filler is still wet. If edges are let dry they will require a lot of sanding or two or three coats of filler to correct them.

Bottom angles should be filled with a knife that is wider than the filler left by the flusher, but not so wide as to make a feathered edge that will need extra sanding.

To Fill Bottoms

1. Add a little filler to the bottom of one side of the angle and pull the knife up the angle to blend in where the box left off.
2. Feather the edge.
3. Remove the excess filler.
4. Repeat the same procedure for the other side, taking care not to gouge filler from the other angle.

To Fill Threeways

1. With a 12 cm knife apply a little filler to one side of the angle on the ceiling. Start with the ceiling so that any filler falling into the wall angle is removed when it is wiped.
2. Pull out the filler about 15 cm making sure to float over the wet filler on the intersecting angle and not to gouge filler from the adjacent angle.
3. Feather the edge.
4. Remove the excess.
5. These four passes will fill the two sides of the ceiling angle. Repeat these four passes on both walls to complete the threeway.

Filling Non 90° Angles

Non 90° angles are always filled by hand. The angle boxes cannot be used. The procedure for these angles is the same as for 90° angles, but special care must be taken to ensure that the line of angle is straight. Frequently, non 90° angles are unique and attract attention. This makes it necessary to use more care when filling them.

Angles More Than 90°

1. Pre-fill any high or hollow spots before filling to level out the surface. Disregard at this time what the pre-filling does to the line of the angle.
2. Place a straight edge (piece of bead, straight board, etc.) along one side of the angle the width of the knife from the angle, and run the knife along the edge to fill

this side of the angle. To get a straight line, make sure that the corner of the blade contacts the straight edge.

3. When the first side of the angle is dry, repeat the procedure on the other side.

Flexible Bead In Angles More Than 90°

The centre line of the flexible bead is an excellent guide for filling if it has been applied properly. Keep the corner of the knife in the angle so that the line of the angle is straight (Figure 5-31). It is not necessary to fill into the angle as the metal will accept and hold a painted finish. It is important, however, that the edges of the metal be covered and blended into the wall surface.

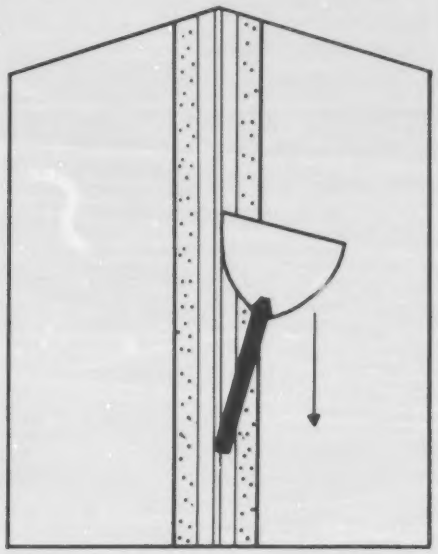


Figure 5-31
Flexible Bead Used as a Straight Edge for Filling

Angles Less Than 90°

These angles are usually found under stairwells and in storage areas. They do not generally require special attention because:

1. They are not prominent.
2. The tape is rarely creased properly and therefore the angle cannot be filled right into the apex of the angle.
3. The line of the angle cannot be seen clearly because of the shadow formed. However, feather the edges keeping the edge straight and remove excess filler from the angle.

Filling Rounded Angles

A wide flexible knife is essential for rounding angles. If the angle has been wiped round to start with, only a skim coat of filler is required to cover the tape. A straight edge can be used to guide the knife down the angle, but it is not essential. To fill rounded angles:

1. Load the entire length of the angle with approximately 3 mm of filler. Make the fill wider than the expected finished width of the angle.
2. Start at the top of the angle and apply pressure to the centre of the knife to achieve the desired curve.
3. Pull the knife down the angle while maintaining a constant pressure on the blade.
4. Finish the bottom by stroking up to meet the spot where the downward pass left off.
5. Check the angle for any air pockets or uneven edges. Any repairs that need to be done will require a complete pass down the angle. It may even be necessary to reload the angle and wipe it again. For this reason, it is critical to keep the thickness of the loaded filler to a minimum.

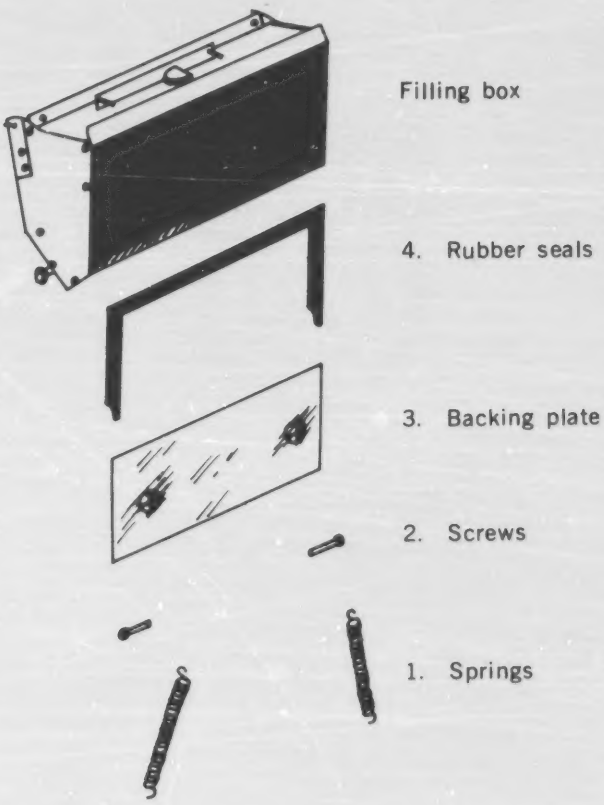


Figure 5-32
Exploded View for Cleaning
a Filling Box

Tool Cleanup

Boxes for flats, angles and fasteners must be kept clean to operate efficiently. While a good washing with a water hose will do a fair job on a flat box, to be thoroughly cleaned the back of the box must be taken apart (Figure 5-32). First remove the springs holding the back of the box in the upright position. Then unscrew the two screws that hold in the back of the box until the back comes out. Note that some boxes have a tab that is simply moved to one side to remove the back plate. To reassemble the box, the rubbers should be in place with the thin piece at the pivot point. The square butt ends meet and form a tight joint at the top of the plate. The rounded edge of the backing plate fits on at the bottom end of the box which is the pivoting point. Wetting the rubber parts makes them slide into the box easier when you install the backing plate. Fasten the screws at the sides to hold in the back and hook up the springs. Store the box with the tension cam in the "O" position so that all pressure is taken off the blade. It is a good idea to oil the wheels and blade adjusting screws at this point so the box will be ready when needed.

Angle boxes are washed by pumping clean water through them. This cleans the valve as well as the inside of the box. Splash some water inside the box to make sure all the filler has been removed. On some angle boxes the back can be easily removed but others are retained by screws. If the back can be removed, a better job can be done. Also wash the flusher head so that the blades are clean and move freely. It is also a good time to oil the flusher head blades and hinge.

To clean fastener spotters the box should be taken apart to remove all the filler from the inside and along the blade.

Finish Sanding

Finish sanding on walls is done after the ceiling is textured. It should be nothing more than a light brushing of the surface of the board. A 100 or 120 grit paper should be used, depending on the type of decoration. The entire surface of the board should be covered to leave the surface smooth and flat. A hand sander may be used for detail sanding such as on the wall angle at the ceiling (top angle) and on threeways. The hand sander is also useful during the final inspection of the job.

Note that it is desirable to sand rather than touch-up with filler because the touch-up will require sanding. Also, sanding keys the filler so that the paint will adhere to it. Be careful, however, not to oversand as this can cause hollow spots in the filler which will show up after decorating.

Wet sanding, although not common, is a special type of finish sanding. The purpose of wet sanding, as with dry sanding, is to remove any minor imperfections and key the filler. The tool used is a round sponge about 3 cm thick fixed to a flat disk with a handle. It is dipped into a very thin mixture of filler called slurry and applied to the wall with a circular motion. The thin filler fills in any blemishes on the surface and softens the filler, enabling the sponge to remove any edges. Wet sanding can be done where dust must be eliminated (for example, in additions to hospitals), and on surfaces that will be painted with a highly reflective paint.

A skim coat of filler over the entire surface of the wall is a substitute for wet sanding and is more commonly done.

Sanding Sequence

1. Start from one end of a wall.
2. Sand the vertical angle:
   - Use light pressure and vertical strokes.
   - Clean the line of the angle.
   - Sand the edges.
3. Sand all the fasteners on the wall:
   - Use very light pressure and vertical strokes.
   - Watch for edges.
   - Touch the edges of the flat(s).
4. Sand the butt joints:
   - Use light pressure and vertical strokes.
   - Hold the sander head horizontal for the centre of the butt and vertical for the edges.
5. Sand the top angle:
   - Use moderate pressure and horizontal strokes.
   - Keep the edge of the sander away from texture on the ceiling.
   - Concentrate on the edges of the angle.
6. Sand the flat(s):
   - Sand the centre of the joint first.
   - Use moderate pressure on the centre of the joint and hold the sander head vertical.
   - Sand the edges of the flat with light pressure and the sander head horizontal.

In general the entire surface of the wall should be sanded. The sandpaper should brush very lightly over the bare paper of the wallboard. You should not use the same pressure on the bare paper as is used over the filled areas. The entire surface must be covered so that any spilled filler or texture overspray is removed.

The amount of sanding required will be directly proportional to the quality of the filling job. A good finisher will have little sanding to do.

Final Inspection

Final inspection requires a thorough knowledge of the trade. Otherwise problem areas will be overlooked. The closeness of the inspection will depend on the type of finish going on the wallboard. Normally, a high-wattage light bulb (200 W) in a light extension cord is needed to inspect surfaces that require a highly reflective finish. A 200 W bulb is recommended because it throws enough light to cast a definite shadow. The light should be held at arm's length and pass parallel over the surface. This will create shadows where any scratches or ridges, waves or hollows, may be. A 100 W or 150 W bulb is adequate to inspect a surface to be finished with a flat latex paint.

Practical Checklist

Following is a checklist for examining your own work:

1. Are the filler edges straight and parallel?
2. Are the edges feathered?
3. Are tapes, beads and fasteners covered properly?
4. Is the surface smooth?
5. Is the surface full according to the specifications?
6. Have irregular surfaces been filled level?
7. Are bead edges clean?
8. Has the filler dried in a uniform band?
9. Have all joints and beads been sanded?
10. Has the entire surface of the wall been covered during finish sanding?
11. Have all edges been removed?
12. Has the required touching up been done?

SUMMARY

- Find out the type of finish to be applied to the drywall and with that information decide on the number of coats that need to be applied.
- Filler should be dry before being re-coated.
- Never sand without a mask. The mask must meet W.C.B. standards.

Coats of Filler

First Coat

- Loading coat on beads, butts and fasteners.
- Thick filler is used.
- The angle of the blade is less than 45°.
- Surface should not be rippled or ridged.

Second Coat

- Fills shrinkage from first coat.
- Thinner filler than first coat, usually topping filler.
- The angle of the blade is 45°.

Third Coat

- Leave a smooth finish.
- Thin mix of filler.
- The angle of the blade is greater than 45°.

Skim Coat

- Use thin filler and change the filler on the blade as often as necessary.
- Leave only a film of filler on the wall.
- Skim parallel to filled fasteners, joints, angles and beads.

Filling Passes (or Strokes)

Loading Pass

- Load the joint uniformly to the approximate width of the fill.
- Make only one pass over an area.
- Decrease the angle of the blade as the blade moves forward.

Feathering Pass

- Blends the edges of the filler into the wallboard.
- Use a flexible blade for feathering.
- Place the blade end on the outside edge of the fill, not beyond it.

Removing the Excess

- Removes filler to establish the depth of the fill.
- Bead should be full.
- The surface should be level and free of ridges or lines.

Rough Sanding

- Rough sand with 80 grit paper or by scraping with a blade.
- Remove all edges and ridges in the filler between coats.
- Do not sand so much that the tape becomes exposed.

Finish Sanding

- Finish sanding with 100 or 120 grit paper.
- Remove any edges or ridges in the filler.
- The entire wall should be touched with the sander.

Filling Bead

Before the first coat and between successive coats, remove any bumps, ridges, or other irregularities either by scraping with a blade or by rough sanding.

- The first coat on the bead should be no wider than 25 cm.
- Each successive coat should cover the edge of the preceding coat.
- The width of finished bead should be approximately 30 cm.
- The bead must be full over the width of the fill.
- Tops of bead must be done while the bottoms are still wet to avoid cracking where tops join the bottoms.

- Leave as few ridges or edges as possible.
- Fill tight to the floor and to the ceiling.
- Level out the filler where the bead is joined.
- Clean off the finishing edge of bead immediately after filling the bead.

Filling Butts

Before the first coat and between successive coats, remove any bumps, ridges, or other irregularities either by scraping with a blade or by rough sanding.

- The first coat should cover the tape (a thin coat) and be about 25 cm wide.
- The second coat is on either side of the tape (not over the tape) and should be about 60 cm wide overall.
- The third coat, if there is one, is a thin polish coat that covers the entire surface of the butt, leaving a 60 to 75 cm finished width.
- Leave as few ridges or edges as possible.
- Finished butt joints should make a smooth, level surface with the rest of the wall to within 2 mm in 1200 mm.

Filling Butts By Machine

Before the first coat and between successive coats, remove any bumps, ridges, or other irregularities either by scraping with a blade or by rough sanding.

- Uneven butts should not be run by machine.
- Check for the correct blade height.
- Three coats are required.
- The first coat is done with the 25 cm box, the second and third with the 30 cm box.
- Make sure you do not overfill the tape.

Filling Flats

Before the first coat and between successive coats, remove bumps, ridges, or other irregularities either by scraping with a blade or by rough sanding.

- The first coat should cover the tape and be no wider than 25 cm.
- With high shrinkage fillers, leave 1 mm to 2 mm build-up; with low shrinkage fillers leave the filler level with the board, and with non-shrinking fillers (i.e., fast-set) leave the fill slightly hollow.
- Successive coats should cover the previous coat with the final coat being approximately 30 cm wide.
- Fill flats right over butts, and tight to angles and to the finishing edge of beads.
- Leave as few ridges or edges as possible.
- Finished flats should be level with the surface of the board to within 2 mm in 1200 mm.

Filling Flats By Machine

Before the first coat and between successive coats, remove bumps, ridges, or other irregularities either by scraping with a blade or by rough sanding.

- Two or three coats are required depending on the type of decoration.
- The most common combination of boxes is a 25 cm for the first coat and a 30 cm for the finishing coat(s).
- Check for the correct blade height.
- Use the appropriate consistency of filler for the coat being applied and the right machine setting.
- Use the proper grip that does not put undue stress on your back or arms.
- Apply pressure only when the box is moving and keep the box perpendicular to the joint.
- Keep the blade free of hard or excess material.
- Touch up at the ends of the joints and where the box is lifted off the joint while the filler is still wet.

Filling Angles

- Rough sand after taping if necessary.
- Angles require one coat.
- When filling angles by hand the second side of the angle can't be filled until the first side is dry.
- The angles in a room are done by hand in a set sequence to avoid blending with wet filler.
- Apply the least amount of filler as possible over the tape, a maximum of 1 mm.
- Fill threeways so that they are square and smooth and have feathered edges.

Filling Angles With Machines

1. The 8 cm flusher head is best to use on angles.
2. Check the leading edge of the flusher for rough edges that could tear the tape.
3. Keep the back edge of the flusher blade clean.
4. Grip the angle box in the proper way so that undue stress is not put on your arms or back.
5. Angle bottoms and threeways have to be wiped by hand while the filler from the machine is still wet.

Filling Fasteners

Usually three coats are required to fill fasteners.

- Each coat should completely cover the edges of the preceding one, and only a skim coat should be on the board.
- Do not build up filler over fasteners.
- Repair defects on the surface of the board around the fasteners.
- Pre-fill nails in joints and near angles and beads.

Filling Fasteners By Machine

- Requires three coats.
- Make sure the blade is the right height.
- The box should be moving when pressure is applied.
- Keep the trailing edge of the blade free from excess filler.
- Remove any excess filler that may be left at the end of a pass.

Filling Sleuth Sheet

Problem	Cause	Solution
Filling By Hand		
Fish eyes in filler	Filler mixed too thin. Too deep a fill.	Thicken material. Decrease depth of fill.
Lines in fill.	Filler on back edge of blade. Too many passes with blade to smooth mud by increasing pressure each pass.	Keep finishing blade clean on back as well as front. Develop ability to smooth mud with one pass. Apply more mud if more passes are required.
Middle length of bead hollow, top and bottom full.	Too much pressure on trowel due to standing up when completing pass.	Compensate for standing up by lessening arm pressure.
Baseboards.	Trowel not started at very bottom or top of bead.	Use wider trowel. Keep floor at bottom of bead clean.
Bead too hollow.	Too much pressure on blade. Mud too thin. Blade not flat. Ends of blade worn round.	Decrease pressure and decrease angle of blade to wall. Stiffen mud. Tap blade until it is flat or curved away from wall. File blade to keep it square.
Flange shows through filler.	Bead improperly applied.	Repair bead. Float over bead with trowel.

Filling Sleuth Sheet

Problem	Cause	Solution
Ripple in bead filler.	Flaw in bead. Trowel jumping.	File bead smooth or flat over indentation. Hold trowel tighter and decrease angle of blade and pressure.
Large liftoff.	Lifting blade off bead too fast.	Blade should be moved 30 cm past previous fill while gradually decreasing pressure.
Scratches in filler.	Foreign material in mud.	Clean floor around bottom of bead before filling.
Filler rolls onto edge of bead and other side.	Trowel not moved along bead properly. Too much filler on blade.	Blade should be pulled on a slight angle toward edge of bead. Carry less filler on blade.
Edges are not feathered.	Not enough pressure on feathered edge. Blade is round. Blade held too flat.	Turn open end of trowel handle to feathered edge. File blade to make it square. Increase angle of blade.
Machine Filling Fish eyes.	Too thin a mix of filler. Too deep a fill.	Thicken material. Increase number on cam of box. Fill by hand.
Rough finish.	Filler on back of blade. Too thick a mix. Too deep a fill.	Keep back edge of blades clean. Thin out mix. Fill by hand.
Large amounts of filler in angle at beginning of run.	Too much pressure put on box before box is moved.	Apply pressure to box only once box is moving.
Large liftoffs.	Lifting box off the wall at right angles.	Remove box in a sweeping arc.

Filling Sleuth Sheet

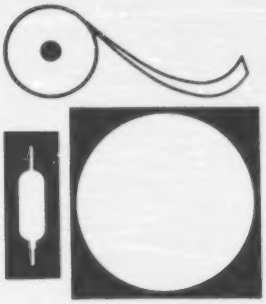
Problem	Cause	Solution
Scratches in filler.	Foreign material caught on leading edge of blade.	Keep leading edge of blade clean.
Line of filler on outer edge of fill.	Blade is covered with excess filler.	Keep blades and other parts clean.
Edges are not feathered.	Blade is not adjusted properly. Angle is not 90°. Flat or butt joint is not level.	Adjust blade. Use small flusher head or fill by hand. Fill by hand.
Ends of joints are rough.	Excess filler has not been touched up.	Touch up end of runs with knife.
Dry spots in fills.	Box is empty. Filler too stiff. Inconsistent pressure on box.	Refill. Thin filler. Practice maintaining consistent pressure on wall.

EXERCISE

1. What is the best type of filler to use on deep fills?
2. Why should taping filler not be used for a third coat?
3. What is pre-filling?
4. Why is pre-filling important in producing a good job?
5. What are five areas to check for pre-filling?
6. Where should you check a fill to see if it is dry? On:
   - Beads?
   - Butts?
   - Flats?
   - Angles?
7. What are three ways to check if filler is dry?
8. List the coats of filler required for a paint finish on:
   - Fasteners
   - Flats
   - Butts
   - Angles
   - Bead

9. List the coats of filler required for a textured finish on:
   - Fasteners
   - Flats
   - Butts
   - Angles
   - Bead
10. How much filler should be left on a loading coat for:
   - Powdered filler?
   - Pre-mix filler?
   - Fast-setting filler?
11. What should a first coat look like?
12. What should a second coat look like?
13. What should a third or polish coat look like?
14. What are the purposes of a skim coat?
15. When is a skim coat necessary?
16. What should a good skim coat look like?
17. Using a knife requires a combination of what two things?
18. What is the proper grip for holding a trowel?
19. What are the four basic passes for filling?
20. When making a loading pass, the angle of the blade to the wall is _____ and the pressure is _____.
21. What is the purpose of the feathering pass?
22. After removing the excess, the fill should be _____.
23. What should be done to remove lumps and ridges between coats of fill?
24. Where is a hand sander often used when finish sanding?
25. How should a loading pass on bead be finished off?
26. On vertical bead, why should the excess be removed upwards rather than downwards?
27. What must be done when intersecting bead is not flush?
28. What technique should be used when removing excess filler from bead around windows and archways?
29. What is the main difference between filled joints on flat and curved surfaces?
30. What must be done when filling uneven butts?
31. What is the approximate finished width of a butt joint? A flat joint?
32. If the full width of the tape can be seen within a few minutes of filling a flat, what has been done wrong?
33. How do you correct a filling box that is not feathering properly?
34. What combination of boxes is accepted as standard for filling butts and flats?
35. When starting a joint with a box, when do you apply pressure in relation to moving the box?

36. How is pressure applied to a filling box on a ceiling?
37. How many coats should be applied to fasteners?
38. What sequence of knifes is recommended for filling fasteners by hand?
39. What is the sequence of boxes used for filling fasteners for a smooth finish? A textured finish?
40. Why should you use a knife at least 10 cm wide to wipe angles by hand?
41. How much filler should be applied when loading an angle by hand?
42. True or False? It may be necessary to run an angle several times with an angle box to get a smooth, feathered angle.
43. True or False? If you get really good with an angle box, you can do the bottoms and threeways with it.
44. What technique is used to get a straight line in an angle that is more than 90°?
45. How much filler should be loaded on an angle that is to be rounded?
46. Before cleaning a filling box, what must be done to do a thorough cleaning job?
47. What is the sanding sequence for a wall?
48. What is needed to carry out a final inspection of a drywall finishing job?



Texturing

MODULE 6

INTRODUCTION

Texture is sprayed on ceilings and walls by machine in a wide assortment of patterns. Texture can also be applied by hand and trowelled or tooled into patterns, shapes, geometric designs or virtually any design the finisher can dream up. Texture requires an undercoating of paint and the texture itself can be white or colored. The point to note about texture is that in most cases it is the final decoration for the wall and therefore must be done well.

There is a misconception as to the acoustic value of texture. Texture is primarily decorative; it provides little soundproofing. True acoustic materials must be sprayed or trowelled on at a thickness of 1 cm or more to be effective. Since drywall textures are sprayed on at a thickness of 2 mm to 3 mm, the amount of sound absorption is minimal.

Types Of Wallboard Texture

Three types of texture materials are used in the industry: hard, soft, and self-priming. Hard texture consists of a binder and limestone, a formulation similar to fillers. It may also contain an aggregate. It dries hard and is very white. When hard it is slow to take on moisture, making it good for use in rooms with moderate moisture conditions. Once dry, hard texture is very resistant to wear making it suitable for walls. Because hard texture does not cover the entire surface of the wall, it requires an undercoat as a background. Hard texture is used for orange peel texture, splatter coats, hand-applied textures, and knockdown finishes.

Soft texture consists of a binder, limestone for color, and a crystaline porous material called perlite for decoration. Since the perlite particles are easily rubbed off, soft texture is used only on ceilings. Soft texture is not suitable where moisture is present such as in bathrooms because perlite is porous and absorbent. Soft texture covers the entire surface of the ceiling but contains no pigment to seal the surface. It therefore requires an undercoat of good sealer. Owing to the larger size of its particles, soft texture is superior to hard textures in hiding ability.

Self-priming texture contains a decorative polystyrene chip aggregate. The chips are similar in appearance to acoustic textures, but they have no real sound-deadening ability. Because the aggregate can be easily rubbed off, self-priming texture is used only on ceilings. No undercoat is required because the texture contains a powdered latex paint. Since the polystyrene chips do not absorb water, self-priming texture is good for bathrooms and kitchens.

Acoustic Texture

Acoustic texture absorbs sound. To be effective it must be applied at a thickness of 1 cm or more. Fibres help to hold the texture together creating a multi-surface material that becomes a trap for sound. Acoustic texture is soft and therefore can be used only on ceilings. It can absorb and release moisture without bond failure, making it useful in high-humidity conditions such as swimming pool ceilings.

Glitter

Glitter is made from colored plastic, metal, or glass. It is an added feature to texture that enjoys some popularity. Common examples of colored glitters are: red, gold, silver, blue and green. Other more exotic colors are available, but they are not as popular. Colored glitters are visible under all light conditions. On the other hand, clear, clear iris, and mother of pearl glitters reflect artificial light only. They cannot be seen during daylight, but at night reflect every color of the spectrum. Dry glitters in any combination of colors are blown on immediately after the texture is applied.

Surface Preparation

Texture will not cover surface defects because the aggregate particles take the shape of the defects and highlight them (Figure 6-1). The degree to which a defect is highlighted depends on the angle of the spray and the number of particles per square centimetre. If you try to hide the defect with more texture it will change the overall appearance of the surface and make the defect even more apparent. Before texturing, fill scratches and depressions with slow-setting filler (allow to dry) and sand down ridges.

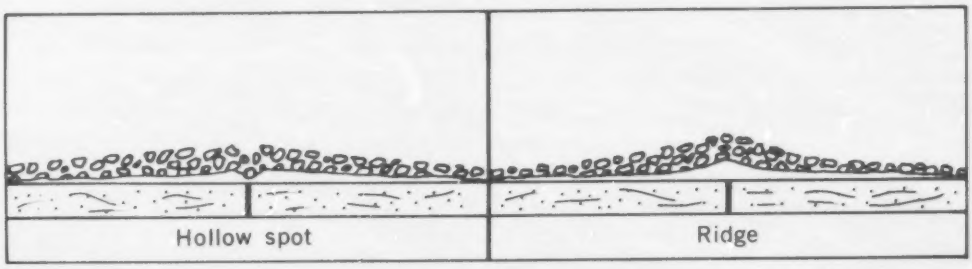


Figure 6-1
Texture Takes the Shape of Surface Defects

Joints and nails must be full and smooth for texturing. Angles should be smooth and feathered or they will show through the texture. Any dirt or chalk-line marks on the surface should be treated as stains and sealed, otherwise they will bleed through the texture. The best treatment is a low luster, fast drying material such as lacquer. Of the three textures, hard texture requires the most careful preparation (similar to that for a flat latex paint), and self-priming the least.

Textures should never be sprayed directly onto concrete because a chemical reaction occurs that causes the binder in the texture to fail. To prevent this problem trowel on

concrete seal, a gypsum-based material with perlite to make it white, to a thickness of 3 mm or less. Any thicker application will cause cracking and peeling. Concrete seal provides a keyed and neutral surface to which the texture adheres.

Design Layouts

Designs can be made with texture materials. Although geometric designs are most common, the possibilities are limited only by the finisher's imagination.

Before attempting to put on a design, measure the diagonals of the ceiling or wall (Figure 6-2). If the diagonals are significantly different, it means the square or rectangle represented by the wall or ceiling is out of square and a geometric design is not recommended as it will only emphasize the defect. Also measure the width of the rectangle at both ends and the length at both ends. If the widths or lengths are out by more than 2.5 cm in 3 m a geometric design is not recommended.

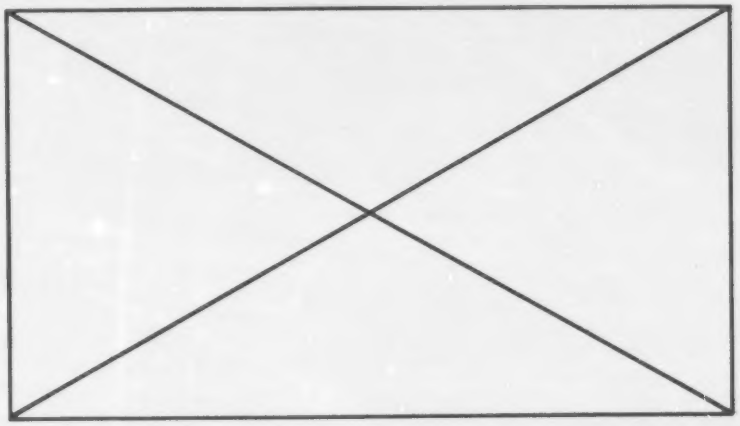
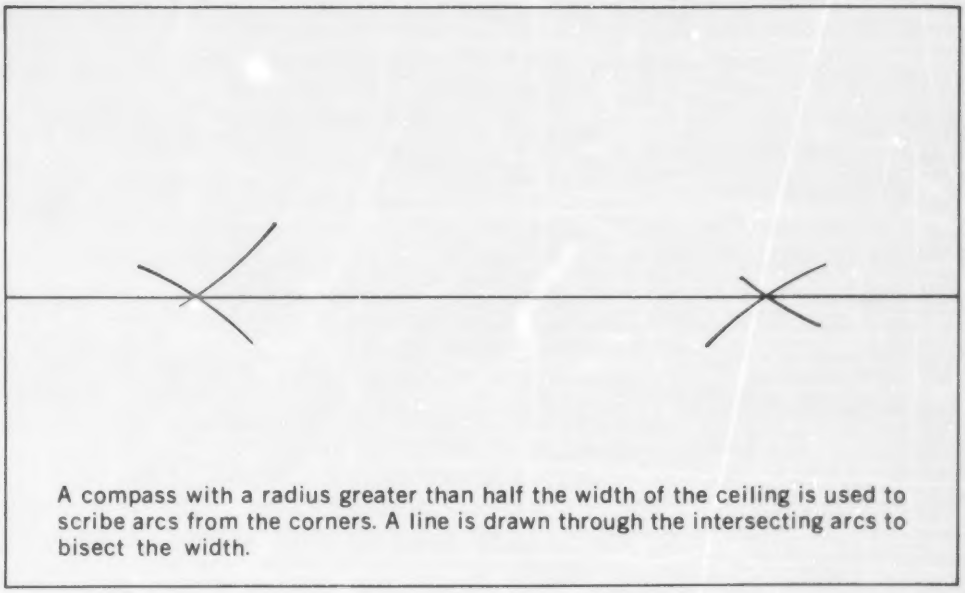


Figure 6-2
Measure the Diagonals of the Surface

The first step in laying out a textured pattern on a ceiling or a wall is to establish reference lines from which all measurements will be taken so that the design will be square and centered. This is necessary because not all ceilings or walls will be square or straight.

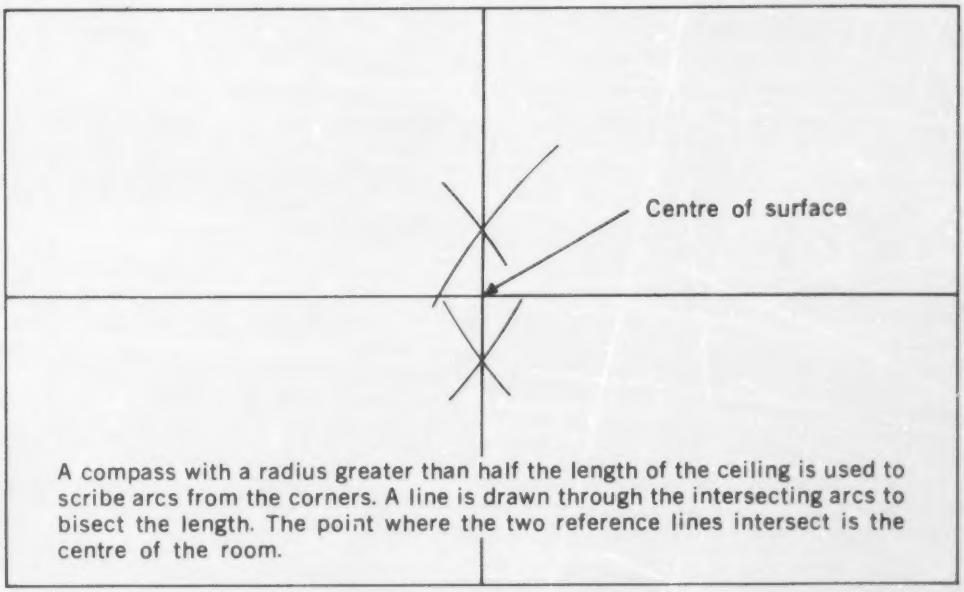
The first reference line is established from the width of the ceiling using a large compass (Figure 6-3). This line can be made with either a chalk line or a dry line. If a chalk line is used the chalk must be treated to prevent the color from bleeding through the finished texture. The dry line can be left in place, or a long straightedge can be used to draw in a line with a pencil using the dry line as a guide. The same method is used on the length of the ceiling for the next reference line to establish the centre of the ceiling (Figure 6-4). The intersecting lines cross at 90° and all measurements for the design can be made from these lines, not from the edge of the ceiling or wall.

When a border is part of your design (Figure 6-5), having decided on the width of the border, take the first width measurements at the shortest end of the surface (assuming



A compass with a radius greater than half the width of the ceiling is used to scribe arcs from the corners. A line is drawn through the intersecting arcs to bisect the width.

Figure 6-3
Bisect the Width



A compass with a radius greater than half the length of the ceiling is used to scribe arcs from the corners. A line is drawn through the intersecting arcs to bisect the length. The point where the two reference lines intersect is the centre of the room.

Figure 6-4
Bisect the Length

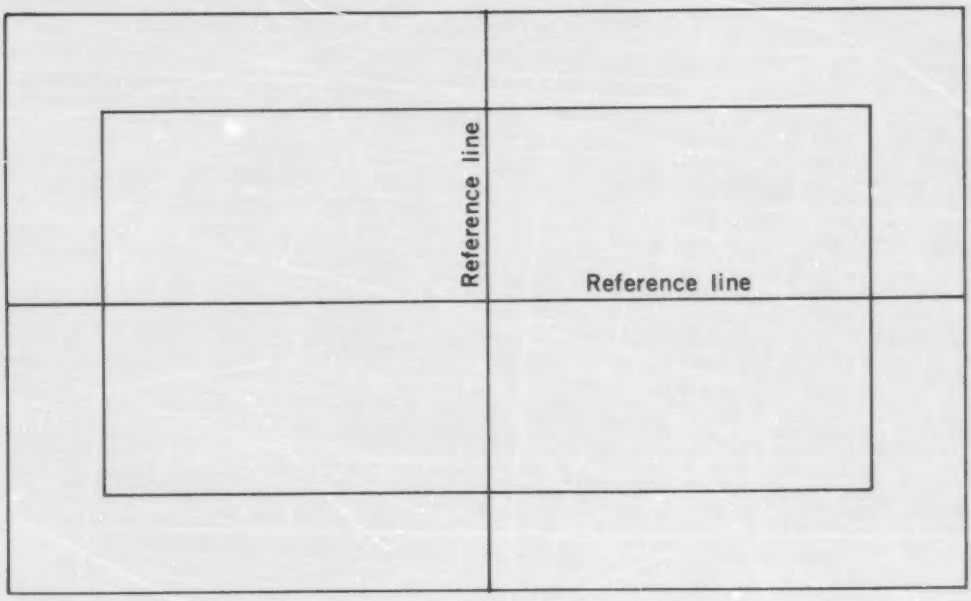


Figure 6-5
Simple Border Design

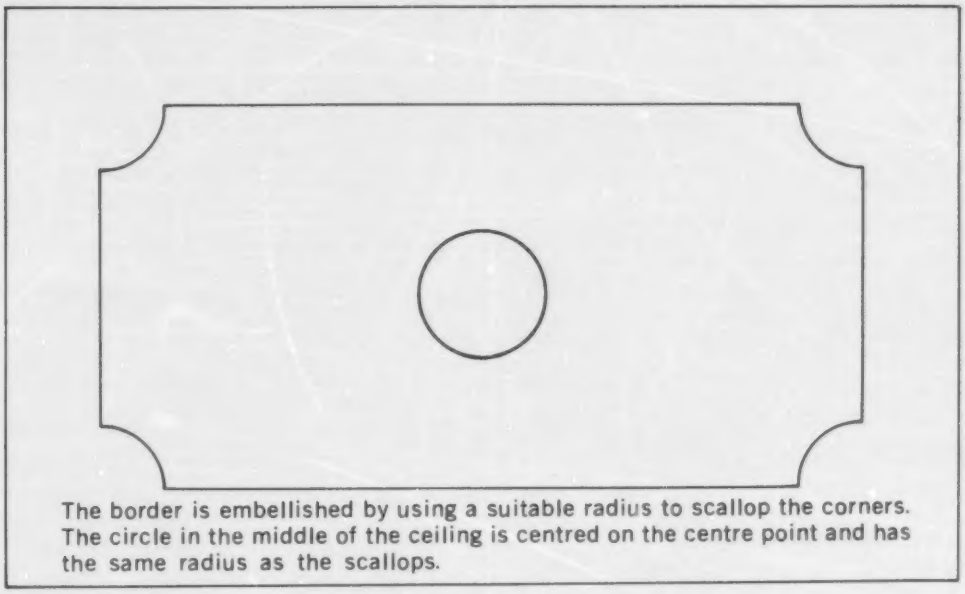

The border is embellished by using a suitable radius to scallop the corners.
The circle in the middle of the ceiling is centred on the centre point and has
the same radius as the scallops.

Figure 6-6
Ceiling Design

the ends are not exactly the same), and similarly take the first length measurements at the shortest side. In this way the border will not be less than what you decided on, i.e., if you took the first measurements from the longest end, the border would get narrower towards the shorter end. The point here is that a wider border will hide defects better than a narrower one.

An example of a ceiling design is shown in Figure 6-6. Large, bold designs are best suited for texture; small shapes are difficult to texture and don't stand out very well. When possible, use an accurate method of drawing to keep lines uniform and the design professional in appearance.

Using Color

The use of color with textures, as with many things, can either add to the attractiveness of the job or detract from it. Some of the basics of using color are covered here.

Characteristics Of Color

Colors are warm or cool. Warm colors appear to advance toward the viewer, stimulating the nervous system and encouraging activity. Warm colors such as red, orange, earth-tones, and yellows are best used in active areas of a house or a building. Cool colors tend to create a relaxed mood; blues and greens are in this category, as well as most colors derived from them. Areas that are primarily for relaxing, such as dining rooms or bedrooms, lend themselves to cool colors.

Dark colors close in around you and make a room look smaller, while light colors make the room look bigger. This is an important point when wanting to change the appearance of a room without changing the structure. For example, if a ceiling is too high, use a colored texture to make it appear lower; the higher the ceiling the darker the color that can be used.

The availability of sunlight to the room is another factor when choosing color. Rooms with poor daylight should not have dark colors because they do not reflect as much light and will make the room seem smaller and darker. On the other hand rooms having a lot of available light if painted white will tend to dazzle you on a bright day.

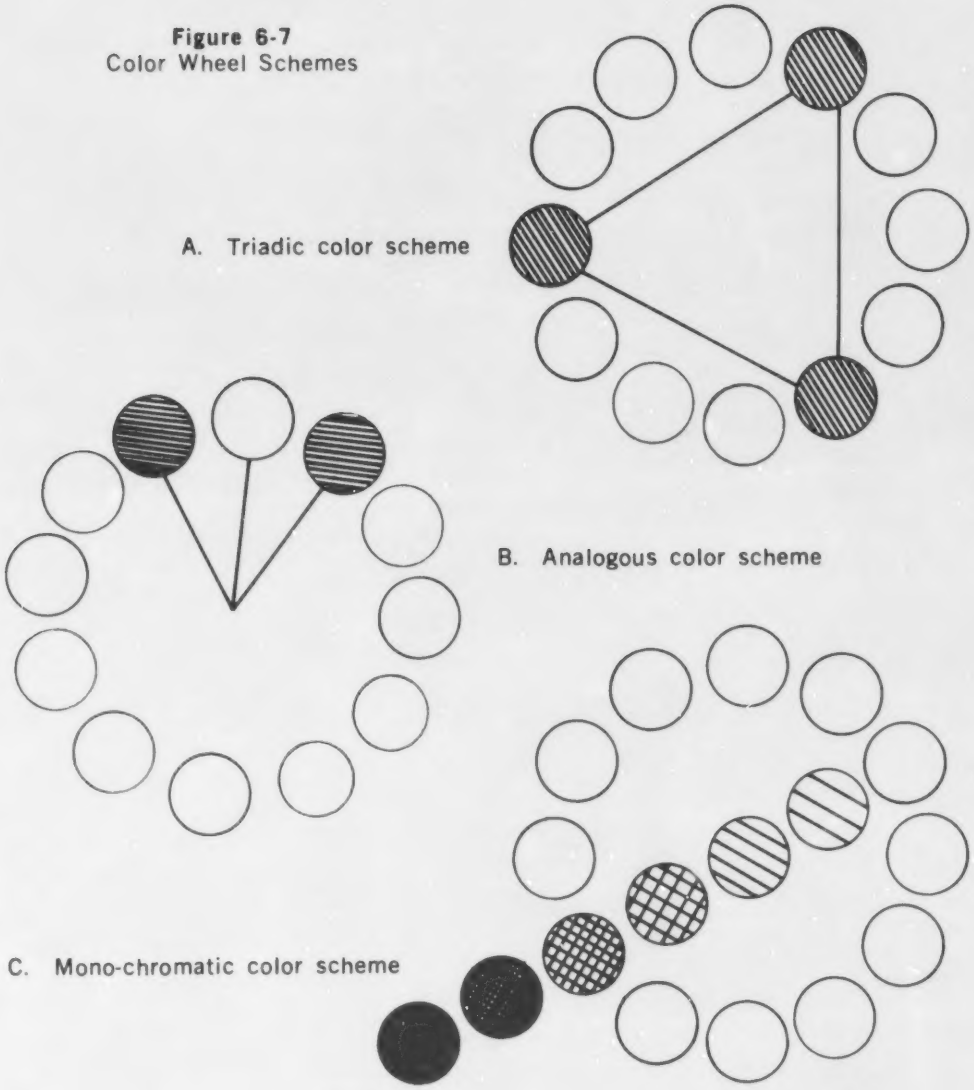
The type of artificial light used in the room will also affect the choice of colors. Incandescent bulbs throw a warm light and make any color in the room appear warm. This is because incandescent light brings out the browns, reds, and yellows and subdues the blues and greens. Fluorescent light is a cool light and will make blues and greens stand out even more. Naturally, the furniture, carpets, and curtains will have an effect on the over-all appearance of the room, but they will be chosen by the owner of the house or building to complement or contrast with the color of the texture.

Color Wheel

A color wheel is an invaluable aid for the drywall finisher when working with colors. If your advice is asked the color wheel will help you to match colors to create a desired effect. Note, however, that when the color scheme is chosen by a professional interior decorator, do not tamper with it.

Colors directly across from one another on the color wheel will clash and must not be used together. By drawing an equilateral triangle between any three colors you will

Figure 6-7
Color Wheel Schemes



A. Triadic color scheme

B. Analogous color scheme

C. Mono-chromatic color scheme

come up with three colors that will complement each other. This is known as a triadic color scheme (Figure 6-7) and is suitable for traditional furnishings. Another color scheme is found by choosing a color on the wheel and then picking one on either side of it; this gives an analogous, or related, color scheme (Figure 6-7). It is a restful scheme. It is the easiest to do well and goes best with modern furnishings. A third color scheme, mono-chromatic, is one that is based on one color and different shades or hues combined with neutral blacks or white (Figure 6-7). A mono-chromatic scheme is restful but monotonous unless the room has interesting shapes or textures.

Note that the owner of the building or the person in charge should always be consulted before any color is applied.

Coloring Texture

Ideally, when mixing colored texture, you should have a container large enough to mix all the texture needed in one batch. This way the color will be uniform, which is important because the eye is drawn to texture surfaces and any variation in color will be readily spotted. Large containers, however, are not always available and the colored texture may have to be mixed in smaller batches. To get color uniformity in this case remixing is necessary. Two common methods of remixing are:

1. Say you mix three batches in three pails. Gather three empty pails the same size or bigger. Take the first full pail and pour one third of it into each of the three empty pails. Do the same with each of the other two full pails. This gives three pails of uniformly colored texture.
2. Again, say you mix three batches in three pails. Pour equal portions from each of the three full pails into an empty fourth pail. Use the texture from the fourth pail, and when returning for a refill, again pour equal portions from the original three batches. This also ensures color uniformity.

Standard paint tints are suitable for tinting texture.

White texture is often put over a colored background to produce a subdued color after texturing. The addition of the white texture will tone down the background so much that a fluorescent red will look like a normal red and a normal red will appear as a pastel color. The desired effect must be carefully determined and the background color chosen so that it is brighter than the desired finished color.

Masking

When spraying texture the nozzle can be controlled to some extent. However, there will always be a certain amount of overspray from which other material and finished work should be protected. If possible it is best to have rooms clear of things that could get sprayed. When spraying ceilings remember that the cleaner the walls are kept the easier they are to sand.

If the sanding is to take place right after the ceiling is sprayed, the top angle must be protected since that is the area that will receive the most overpray. One way to do this is to use a paper apron. The minimum width of the paper should be 30 cm as this is the least amount of overspray that can be expected.

Masking Machine

A machine is available that holds the paper and a roll of masking tape (Figure 6-8). As the paper is pulled out, the tape is applied to the edge of the paper. One person can apply the paper by pulling off lengths that can be easily handled. With two persons one should be on stilts so that the angle can be easily reached, and the other should be on the floor in front to make sure the machine is working properly and to hold the paper. The person on the floor should neatly drape the paper over an arm so that the paper can be readily pulled to the ceiling in long strokes. Hands can be protected by wraping masking tape around each individual fingertip.

The filler on the top angle must be dry and free from dust so that the masking tape adheres properly. Therefore, don't sand the top angle before the ceiling is sprayed. Stick the tape as closely as possible to the apex of the angle to minimize the amount of texture that will come in contact with the top of the wall. No more than half the width of the tape should stick out beyond the edge of the paper; if there is more the tape is likely to stick to other parts of the paper or tape and slow down the process.

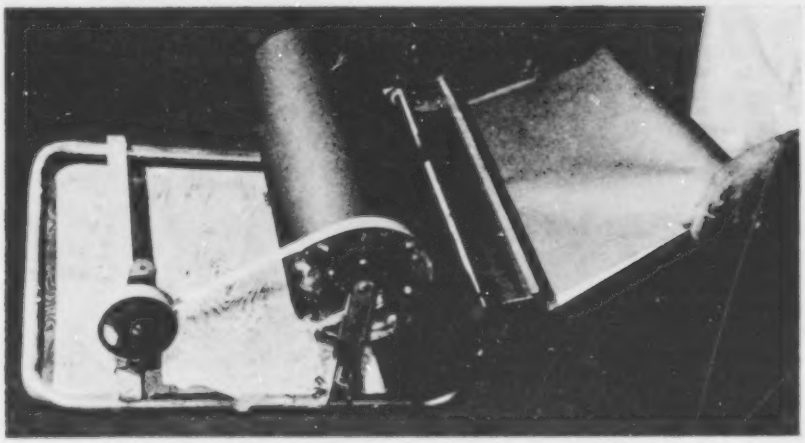


Figure 6-8
Masking Machine

Polyethylene Cover

Polyethylene, also known as "poly" or "plastic", is used when spraying to cover:

- Windows when a paper apron is used.
- The rest of the wall that the paper apron doesn't cover.
- The entire wall when no paper apron is used.

To keep the poly in place, the best method is stapling. Start stapling at a doorway to allow easy access to the room. After removing the poly fill the staple holes with filler.

A drawback to using plastic without a paper apron is that it is difficult to get the plastic close to the angle and therefore there is more overspray on the walls. Because of this overspray the walls cannot be sanded until the next day.

Undercoating

In short, good texture undercoat paint must have a flat finish, must properly seal the surface, and must uniformly cover (hide) the surface.

Texture Undercoat Paint

Not all paints can be used as an undercoat for texture. The undercoat must have a flat or non-gloss finish to prevent telegraphing of the background through the texture.

Gloss paints are also unsuitable because they do not offer a keyed surface for the texture to adhere to.

The undercoat must seal the surface to prevent "photographing" of the joints. Filler is a natural sealing material that does not readily absorb water, whereas paper will absorb water more quickly. If the paper around the filler is not sealed, the difference in absorption rates causes a difference in the color of the joints. The sealer prevents water from being absorbed by either the paper or the filler. This means that the water evaporates at the same rate on the surfaces of both, therefore the same color is maintained.

The paint must also hide joints, that is it must have enough pigment to give the entire surface the same color. If it does not, the texture will emphasize the transparency of the paint and the joints and nails will show through the texture.

When buying undercoating paint, choose one that meets all three criteria. Note that even an expensive sealer usually will not hide well. It is designed to seal the surface with a film, and it does this with a high proportion of binder and little pigmentation. Similarly, a good hiding paint will be highly pigmented but low on binder; therefore it is not a good sealer. Special texture undercoat paints are on the market and are preferable to other paints or sealers.

A texture undercoat paint must dry quickly, because the finisher wants to begin texturing as soon as possible after painting. Latex paints meet this criterion because they are water-based and thus evaporate faster than oil-based paints. As a latex paint dries, it forms a film on the surface and dries inward. This film must be formed before texturing begins. If the film does not have a chance to completely form, the water in the texture will dissolve it and the paint will not seal, resulting in photographing of the joints.

Alkyd paint is becoming increasingly popular as a texture undercoat paint because it dries fast and covers well. Cleanup with alkyd takes longer than with latex because thinner must be used.

The watering-down or thinning of paint is not safe unless recommended by the manufacturer. Thinning paint to make it go further actually does the opposite in some cases because the pigment becomes diluted, reducing the hiding power of the paint and thus making it necessary to use more. Another problem with thinning is that the binder may be over extended and a good seal will not form. After a thorough mixing, paint should be used as it comes from the can unless otherwise specified. The mixing is necessary to replace material into the emulsion that may have settled to the bottom during storage.

Painting

A paint brush attached for added extension to a piece of wood or metal with masking tape can be used to "cut in" the corners, that is, paint the edge of the wallboard in the angle where the roller does not quite reach. If this is not done, the angles of the room will show as discolored areas after texturing has been completed. Angles should be cut in before applying the paint by roller.

A long handle should be screwed into the roller handle to speed the process of painting the ceiling. The longer the pile on the roller the more paint the roller can hold and the

faster the job will go. Wire screens for rollers can be purchased that fit into a pail eliminating the need for a tray. If a tray is used, one that will hold a lot of paint is best.

When the roller pile is loaded with paint it should be rolled out on the screen or the ramp end of the tray to remove excess paint. This prevents paint drops from splashing on surrounding surfaces and yourself. When painting a wall, start with the roller at the bottom and run slowly up the wall to ensure that excess paint will not be thrown off by centrifugal force. When painting a ceiling, make a slow first pass then faster passes. Move the roller in parallel lines, with a slight overlap. Once an area of approximately one square metre is covered, go back over it in the opposite direction. This will ensure that the paint covers well.

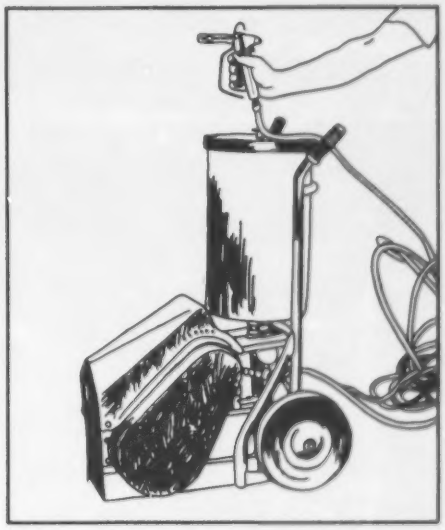


Figure 6-9
Airless Paint Machine

Airless Paint Machines

If an airless paint machine (Figure 6-9) is used for undercoating, the manufacturer's recommendations must be strictly followed. This machine pumps paint at pressures of up to 22 mPa, enough pressure to inject paint under the skin and into the muscle tissue of your body. If you think of the painting gun as being a loaded hand gun and act accordingly you will be safe:

1. Never point the gun at any part of your body or at anyone else.
2. Lock the trigger whenever the gun is not in use.
3. When leaving the gun unattended, even for a few minutes release the pressure in the line.

Paint Gun Procedures

1. Before starting the paint machine, make sure the pressure is turned down. This prevents the motor from starting under load and causing a burned fuse or an overheated motor.

2. Once the machine is running and warmed up, turn to operating pressure. Latex paint requires a pressure of at least 12 mPa for proper atomization. The paint is pumped under pressure to the gun and forced through a small opening called a tip or orifice. The pressure together with the small hole atomizes the paint to produce the fan or pattern of the gun. A .4572 to .5334 tip is used for latex paints. If the pressure can be maintained, the bigger the tip the more paint that passes through and the bigger the fan.
3. Hold the gun approximately 45 cm from the surface for best performance. If the gun is held too far away, the fan will turn to a fog or mist and poor coverage will result. If held too close, there will be a rapid build-up of paint, causing runs or drips on the painted surface.
4. Once you have the proper distance from the surface, move the gun in a line parallel to the surface (Figure 6-10). Do not move the gun in a swinging motion because this means that the gun will be closer to the surface in the middle of the swing or arc than at either end of the swing. A swinging motion results in poor coverage at the beginning and end of passes.

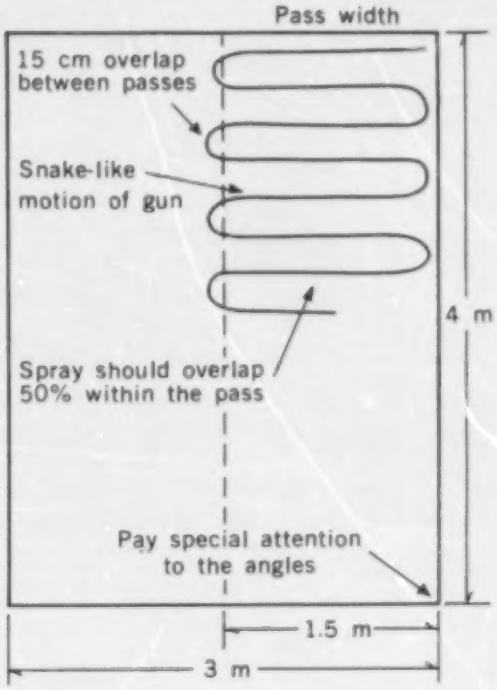


Figure 6-10
Paint Gun Spraying Techniques

5. To prevent paint build-up start moving your hand before releasing the trigger at the beginning of each pass, and continue to move it after releasing the trigger at the end of each pass. If you stop dead or start from a dead stop, there will be a build-up of paint that could result in a drip or run.
6. Overlap the spray 50% within the pass.
7. To cut in the angle, run the fan parallel to the angle. This makes a pencil line of paint, so the gun must be moved fast to avoid runs or drips.

Cleaning Painting Guns

Most painting guns have a self-cleaning tip. Because latex paint is a very coarse material, the tip will occasionally plug. This is indicated by a change in the pattern, a drop in pressure, or a line forming on one side of the fan. To use the self-cleaning tip:

1. Release the trigger.
2. Turn the handle of the self-cleaning tip to the clean position.
3. Aim the tip at the inside wall of the paint container (to prevent paint from splashing back into your face), then pull the trigger. A small burst of paint will clean the tip. Never aim the gun while in spray position into a container. If the trigger is pulled an explosion will result because of the confined space and high pressure.
4. Release the trigger.
5. Return the handle to the spray position and resume spraying. Make absolutely sure that the trigger is released when you move the handle. If the handle is moved with the trigger on, the paint will have nowhere to go but through the nylon packings of the tip and barrel. The gun will thereafter leak and be useless and will have to undergo costly repairs.

When the spraying is finished, run water or a recommended thinner through the lines to clean them, and leave a solvent such as varsol in the pump to lubricate it and prevent rust. Clean the outside of the gun, the lines, and the machine to near-new condition to keep them in good working order. Always release the pressure in the line at the gun before storing the machine and turn off the pressure at the machine. Always lock the gun in the off position when storing the machine.

Texture Machines

There are both large texture machines called roto-stator pumps (Figure 6-11) and small texture machines (Figure 6-12). The large machines use a wand to apply the texture, whereas the small machines use a hopper.

Texture machines run on 140 to 174 kPa pressure, hence they are not as dangerous to use as paint machines. This pressure of compressed air, however, can still be dangerous if the hose is held close to your skin. Treat all texturing or painting machines with respect.

When starting a small texture machine, make sure the pressure valve is released and the bypass valve, if it has one, is open. This allows the motor to run freely when first starting and prevents burning a fuse or damaging the motor. Once the machine is warmed up, close the bypass valve and adjust the pressure. To adjust the pressure, the hopper (Figure 6-12) must be attached to the end of the line. This creates a back pressure the same as if the spraying were proceeding.

With the large texture machine or roto-stator pump, texture is pumped into a hopper with a metal worm gear at the bottom. The worm gear turns in a rubber cylinder and the texture is forced through a hose to a nozzle attached to a pipe called a texture wand (Figure 6-11). The nozzle can be fitted with orifices or a threaded cap to regulate the pattern. A second hose enters the back of the nozzle through a small pipe and carries the air to break up the particles into a fan. This pipe is adjustable just as the trigger in the hopper adjusts the distance between the point of release of the air and the orifice.

Figure 6-11
Large Texture Machine
(Roto-stator Pump)

A slide control on the wand directs air back to the machine to activate a clutch that in turn activates the drive of the worm gear. When the control is pushed ahead, the worm gear stops and the texture stops pumping. There is pressure in the line that causes some material to come out of the nozzle in the form of a fine spray. Some machines have a material shut-off valve positioned where the hose joins the texture wand. This must be in the full open position when spraying or the full closed position when the roto-stator is not pumping. If the flow of material through the hose is restricted in any way the hose may explode and cause injuries.

The roto-stator pump is usually gas-powered and should be properly vented out a window. The lines should be checked for loose fittings before the machine is started. A leak in the line will permit water to escape causing the texture to compact and the line to plug. Do not run the pump without water or texture in the hopper. If the roto-stator is permitted to run dry it will be damaged.

When spraying, hold the nozzle so that it minimizes overspray and is at an angle away from your body. Wear protective clothing with a roto-stator pump because this method can be very messy. Ear protection should be worn as the nozzle has a high-pitched scream when properly set.

Factors Affecting Texture Appearance

There are two types of factors that affect the appearance of texture: machine factors and application factors. These factors can be varied to produce many different texture appearances.

Machine Factors

1. The air pressure of the machine. The lower the air pressure, the coarser the texture.
2. The size of the orifice through which the texture is sprayed. The larger the orifice, the coarser the texture.

3. The thickness of the texture material. The thicker the mix, the coarser the texture.

Application Factors

1. The distance the orifice is held from the surface. The greater the distance from the surface, the coarser the texture.
2. The angle the orifice is held at. The further the angle is from 90°, the coarser the texture.
3. The speed at which the orifice is moved across the surface. The slower the pass, the coarser the texture.

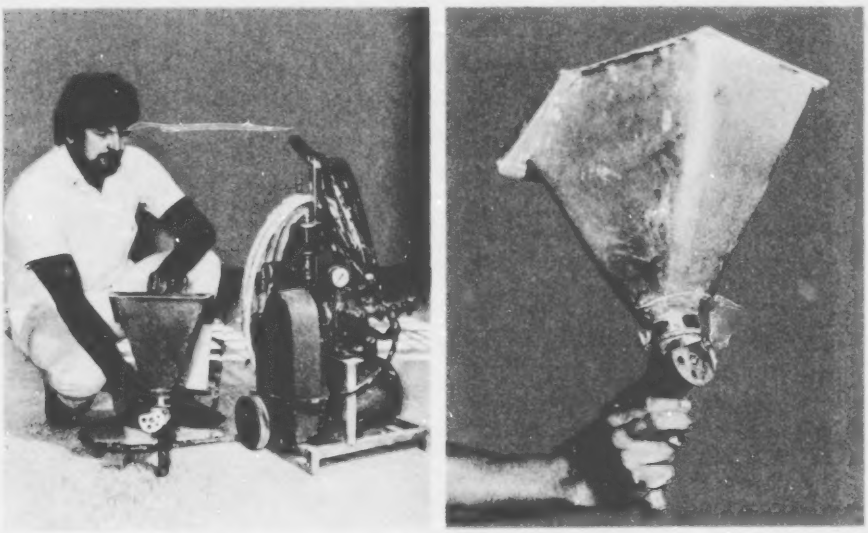


Figure 6-12
Small Texture Machine

Regulating Texture Appearance

Generally, the six factors that affect the appearance of texture are regulated by the finisher to suit personal taste. However, there are two types of texture that must be applied in a certain way. These are self-priming texture and orange peel texture.

Self-Priming Texture

Since self-priming texture is basically paint with a styrefoam chip aggregate, applying it is similar to spraying paint. To be acceptable self-priming texture must completely cover the surface of the wallboard giving a solid, uniform, textured surface. To apply self-priming texture, the following factors must be met:

Machine Factors:

1. High air pressure.
2. The second smallest orifice.
3. A thin mix.

Application Factors:

1. An orifice to surface distance of approximately 45 cm.
2. A 45° spraying angle.
3. A medium to fast speed that covers but does not overload.

Orange Peel Texture

Orange peel texture should completely cover the surface of the wallboard with small pinholes like the surface of an orange peel. Too much texture material causes the pinholes to disappear and the texture to drip or run. Too little material and the surface will not be covered leaving an anemic looking texture. To produce an orange peel textured surface, the following factors must be met:

Machine Factors:

1. High air pressure.
2. The smallest orifice.
3. A thin mix.

Application Factors:

1. An orifice to surface distance of approximately 30 cm.
2. A spraying angle close to 90°.
3. A slow speed to ensure total coverage.

Texture Spraying Techniques

Following are general texture spraying techniques that apply for all textures:

1. Eye protection and a mask are required when using a texture machine.
2. Passes are made along the length of the surface. Since the passes are 1.5 m to 2 m in width, most surfaces can be done in 2 passes.
3. Spread your feet approximately 60 cm apart and shuffle backwards at a rate that gives proper coverage of the surface.
4. The wand or hopper must move in a snake-like motion back and forth across the width of the pass (Figure 6-13). To accomplish this motion the arm is held rigid while the body is rocked from side to side. The wrists should only move at the end of each pass, giving a flick as the wand or hopper is turned back the other way.
5. The wand or hopper should move in straight, not wiggly, lines across the width of the pass.
6. The spray overlap as the wand or hopper is moved back and forth across the width of the pass should be approximately 50%.
7. The distance of the orifice to the surface should be constant.
8. The spraying angle should be constant.
9. The speed at which the wand or hopper moves should be constant.

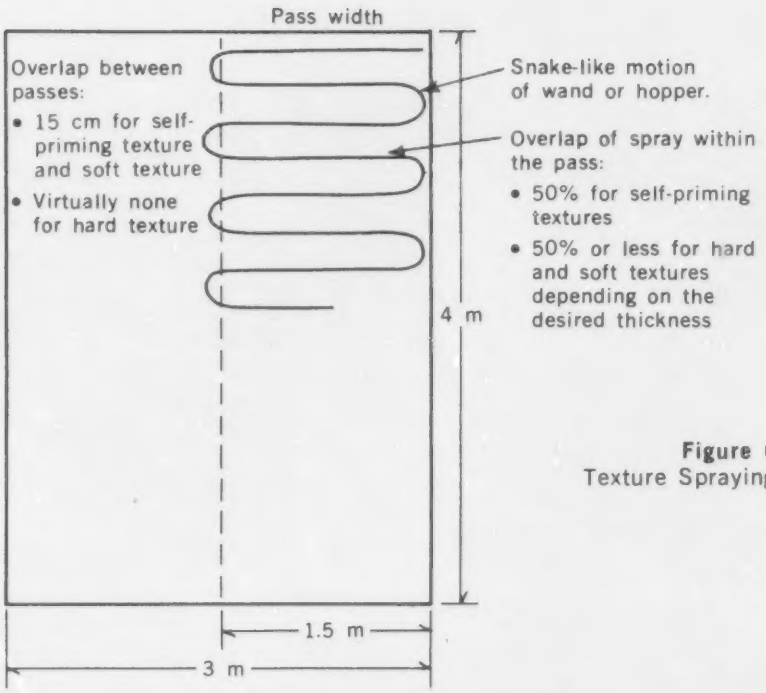

Pass width
Overlap between passes:
• 15 cm for self-priming texture and soft texture
• Virtually none for hard texture
Snake-like motion of wand or hopper.
Overlap of spray within the pass:
• 50% for self-priming textures
• 50% or less for hard and soft textures depending on the desired thickness
4 m
1.5 m
3 m

Figure 6-13
Texture Spraying Techniques

Soft Texture On Flat Ceilings

1. Spray the angles and all around the edges.
2. Make passes down the length of the ceiling.
3. The passes can be made in either direction.
4. Slightly overlap the spray where the passes join.

Hard, Splatter Texture On Flat Ceilings

1. The angles and edges are not pre-sprayed as is done with soft texture.
2. Make all passes in the same direction.
3. Do not overlap at the joint of the passes.

Ceilings With Drops

1. Spray the drop first.
2. Spray the exterior angle of the drop, bisecting the angle with the spray (Figure 6-14).
3. Spray the interior angle of the drop, again bisecting the angle with the spray.
4. Spray the remaining area of the drop.

The reason for this sequence is that if you did the main surface of the drop first and the angles last, you would get a build up on the main surface from the angle overspray and thus the texture would be inconsistent.

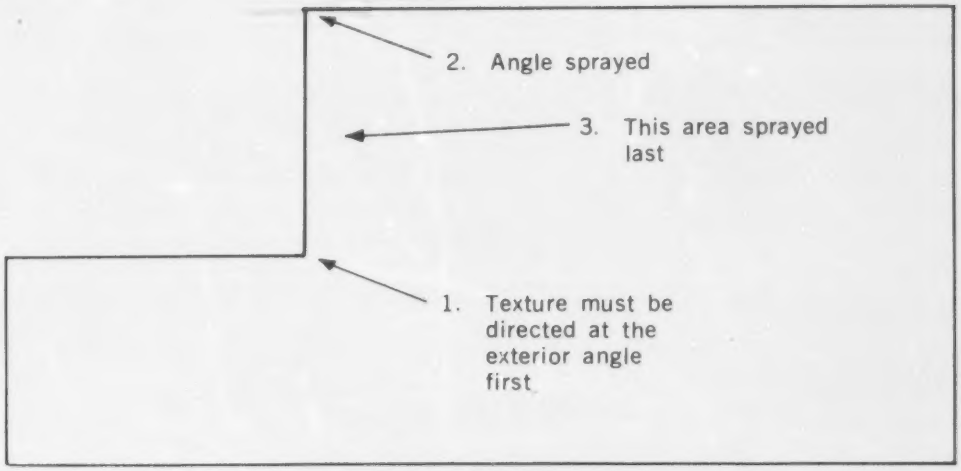


Figure 6-14
Texturing a Drop

Walls

Single, flat walls are done similarly to hard texture on a flat ceiling. If the wall(s) has interior and exterior angles, they should be done first as is described for ceiling drops.

A texture pattern called a knock down texture is used on walls. A knock down texture is one that is applied by machine then "knocked down" with a trowel. California texture is a common knock down texture pattern. To get the best results when knock down texturing walls, it is necessary to spray the walls twice. The first spraying will give the wall a fog coat. The texture mix for this coat should be thin, be applied at a high pressure setting on the machine (140 to 200 kPa), and be sprayed through a small orifice. The fog coat will provide a base for the second coat, which should be slightly thicker and be sprayed at a low pressure through a big orifice. The further the nozzle is held from the wall the bigger are the blobs of spray that hit the wall, since the texture will have a chance to flatten out before it hits. Before trowelling, wait until the texture looses its shine and takes on a dull appearance. Trowelling too soon will cause the texture to spread out too much; too late and the texture will roll and come off the wall with the trowel.

Spraying Over Colored Backgrounds

When spraying over a colored background, watch the pattern of the spray to ensure that it does not bunch up in one area nor is too lean in another. Because the white texture contrasts with the colored background, imperfections in the spray pattern are easily seen. This also holds for colored texture applied to a white background.

Finishing Off Ceilings After Texturing

After the ceiling is textured the protective paper apron must be removed. This should be done as soon as possible after texturing. If left too long the texture will start to dry and adhere to the paper apron. Then, when the apron is removed, it will tear off texture

from the ceiling. After the apron is removed the angles should be cut in and cleaned. A wide blade knife is run along the angle to form a definite line between the wall and ceiling. At the same time, any overspray at the top of the wall should be cleaned. This makes the ceiling look finished and makes it easier for the painter to cut in the angle when the wall is painted. Care must be taken when cutting in and cleaning the angle so that the filler on the angle is not gouged out.

Any overspray on the walls that the paper apron didn't catch should be scraped with a knife. A 45 to 60 cm knife is desirable because it can cover a lot of wall surface in a short time. The knife should be cleaned regularly while scraping to prevent a build-up of texture that smears the wall.

Hand Texturing

Hand application of texture enables the finisher to display artistic talents. But keep these two concerns in mind: high traffic areas should not have soft texture because it will be damaged by abrasion; icicle-type texture finishes should be used only on ceilings where there is no danger of the sharp spikes causing puncture wounds. With hand applied texture, surface preparation need not be as thorough as for machine applied texture.

Hand finishes can be divided into three basic types: built-up textures, one-coat finishes, and stipple patterns. Built-up textures require two coats of texture: a base coat, which must dry, then a second coat which is worked into a pattern. For one-coat finishes, the texture is trowelled on to the wall or ceiling and is then textured with a sponge, brush, or paper. Stipple patterns are applied direct with a texture applicator. At no time should the thickness of a coat of texture exceed 5 mm, otherwise cracking will occur.

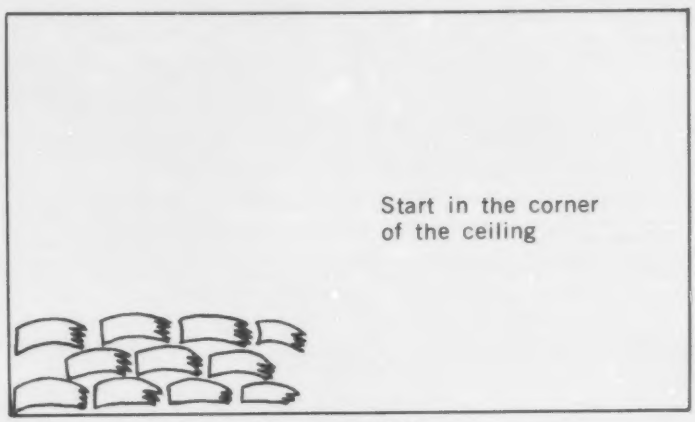


Figure 6-15
Built-up Texture Pattern

Built-Up Textures

A base coat of texture materials is applied to a wall or a ceiling with a trowel. This coat should be smooth and no thicker than 5 mm. Once the base coat is dry, a second coat is

at the same time applied and made into a pattern with a trowel or a knife. The pattern can be any combination of swirls, waves, or streaks. The most important thing to remember is that the pattern must be uniform over the entire wall or ceiling. On ceilings start in a corner and work out (Figure 6-15) so that it won't be possible to see where you started or finished. When applying a pattern to walls, start at a top corner and work toward the bottom. This prevents unwanted texture material from spilling onto the pattern and makes ending the pattern easier and less noticeable.

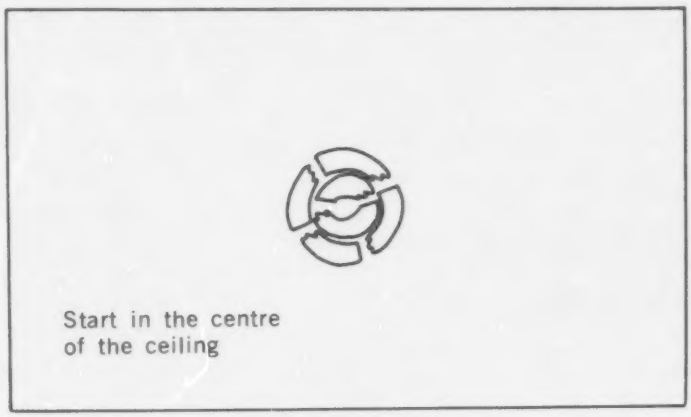


Figure 6-16
Radiating Pattern

One-Coat Finishes

With one-coat finishes, the texture material is first trowelled on and then worked into a pattern while still wet. The amount trowelled on should not be more than can be textured in a few minutes. If too much time elapses the texture will dry, causing an undesired variation. Gouges or ridges left by the blade applying the texture should be removed because they will show on the finished surface.

The texture tool can be any tool or material that gives the desired texture. Most common ones are sponges, brushes, and crumpled plastic or paper. The objective in this type of texturing is to draw the texture material away from the surface to leave a rough texture. It is best on ceilings as the sharp spikes that are left on the surface can puncture the skin.

If you use a round pattern, make it uniform. With one type of round pattern you could start in the middle of the ceiling and have the pattern radiate from a central point (Figure 6-16) or you might establish several points from which the pattern radiates.

Lifting the texture with a sponge can be done by placing the sponge on the surface and pulling down. A slight twist of the sponge as you pull it down will give the pattern a swirled effect. Wet the sponge before you start texturing so that it will have some suction on the texture material.

The surface can also be pulled down with a crumpled piece of paper or plastic. The pattern will cover a large area at one time and will pull down the entire area. However, it is

difficult to keep the texture uniform with this method.

Brooming or brushing of the material gives a rustic effect. Straight lines or swirls can easily be accomplished. The timing between the trowelling of the texture and the brooming will regulate the roughness of the texture: the longer the time, the smoother the texture.

Stipple Patterns

Another type of hand texturing is done by applying the texture direct to the surface with a texture applicator commonly called a stipple pad. Window-washing brushes dipped in a thin mix will produce a sharp, rippled effect that can either be left as is or trowelled to flatten the peaks. Stipple pads (foam rubber covered with a piece of cloth) ranging from 3 cm to 8 cm in diameter will produce an icicle effect. To lengthen the icicles, add latex paint to the mix and use a mix that is about as thick as a second-coat bead filler. The addition of fine perlite will reduce cracking. By varying the thickness and the amount of paint, you will find the desired icicle length. Pour the mix into a small pail that can be held comfortably under your arm. Dip the stipple pad into the mix and then dab it onto the surface. An undercoat of flat white paint on the surface before stippling will help reduce bare spots in the over-all pattern.

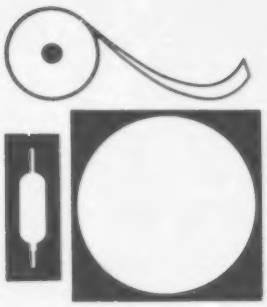
SUMMARY

- There are three basic textures: hard, soft and self-priming.
- Hard textures are mainly used on walls.
- Soft and self-priming textures are used only on ceilings.
- Self-priming and hard textures can be used in bathrooms and kitchens but soft textures cannot.
- Walls in high traffic areas must have smooth textures.
- Glitters of many types and colors can be blown on wet texture.
- Draw reference lines prior to laying out ceiling designs.
- Standard color tints are used to tint textures.
- Colored texture mixed in small batches must be remixed to ensure uniformity of color.
- Use a color wheel to aid in selecting colors.
- Dark colors appear to close in areas.
- Light colors appear to expand areas.
- Colored texture will dry one shade lighter than it appears when wet.
- All textures except self-priming require an undercoat.
- Use a good quality texture-undercoat paint.
- Seal dirt or chalk line marks before undercoating.
- Follow the correct procedures for using a paint gun and for cleaning a gun.
- Texture will not cover ridges or scratches.
- Top angles must be masked off with either plastic or paper to prevent ceiling overspray from hitting the walls. Remove the paper or plastic soon after the ceiling is sprayed.

- The two types of factors affecting texture appearance are machine factors and application factors.
- Self-priming texture and orange peel texture require specific machine settings and spraying techniques; other textures do not.
- Use the correct techniques and sequences when spraying.

EXERCISE

1. What are the three types of texture and where is each used?
2. When is glitter applied?
3. True or False? A surface that is to be hard textured requires less preparation than a surface that will be painted with flat latex.
4. Why do you need to establish reference lines when painting a design on a ceiling or wall?
5. What is the difference between warm and cool colors?
6. How can you avoid different shades of color when applying colored texture?
7. Why is it not a good idea to sand the walls before texturing the ceilings?
8. How much tape should extend beyond the edge of the paper apron?
9. What is the best method of hanging poly?
10. What are the three characteristics of a good texture undercoat paint?
11. Why should you not thin down a texture undercoat paint?
12. What does "cutting in" mean when painting?
13. What are three main safety procedures when using an airless painting gun?
14. How do you prevent paint build-up at the beginning and end of passes?
15. Why must you release the trigger of the paint gun before turning the handle on self-cleaning tips?
16. List the three machine factors and the three application factors that affect texture appearance.
17. True or False? The arm is held rigid when spraying texture?
18. When is a texture ready to trowel for a knock down finish?
19. What must you watch for when spraying over a colored background?
20. How do you cut in a ceiling after it is textured?
21. What are the three basic hand finishes for texture?
22. What is the maximum thickness of a coat of texture for hand texturing?



Repairs and Corrections

MODULE 7

INTRODUCTION

The finisher produces a product that is on display and open to criticism. Problems can develop both during the finishing process and after the job is completed and the building occupied. This module outlines the types of repairs finishers are called on to make.

Repairing Gouges, Ridges and Other Defects As You Go

Repair gouges while the filler is still wet because it saves time. If you let a gouge dry, it will require either three coats of slow-set, or one coat of fast-set plus one of slow-set to repair. Repairing while the filler is still wet allows the filled gouge to shrink at the same rate as the filler around it, leaving no noticeable affect.

Usually, by the time you get to a gouge on wet filler a film or skin has formed on top of the filler. When a blade is run over this film, it causes a tearing of the surface known as a "pull". This occurs usually because you think it is possible to fill in the gouge by drawing the filler already on the wall onto the defective area. The solution is to fill the gouge with fresh filler from your pan or hawk. By putting fresh filler across the width of the blade you will not pull the filler surrounding the defect.

Why does this method prevent pull? The addition of fresh, moist filler softens the film that has developed on the surface of the fill. The filler then becomes thixotropic once more.

Repair ridges as soon as possible after applying the filler. Remove the ridge by running the blade parallel to it (Figure 7-1). Most blades have a slight bow in them; use the bowed out side toward the filler so that the ends of the blade don't dig into the filler. Apply enough pressure so that there is evidence of the knife touching the filler on either side of the ridge. You do not have to put filler on the knife to correct a ridge because the ridge is already too high. If a film has already formed on the filler, lubricate the blade with water. This will soften the film and prevent pulling.

If a ridge is missed when wet and has to be sanded out, sand down the ridge not across it. If you try to sand across a ridge, you usually succeed only in removing part of it. As shown in Figure 7-2, the sander follows the contour of the ridge, grinding out the valleys and knocking the top off the ridge. At first glance it appears that the ridge is removed, but in reality it is not. Further filling over this area will not improve the surface because the blade follows the contour of the surface. By sanding down the ridge the sander only contacts the ridge and does not grind out valleys on either side. It should be pointed out, however, that sanding a ridge is never totally satisfactory and that it is far better to take out the ridge when it is wet.

Figure 7-1
Repairing a Ridge

Although ridges and scratches are the most common types of repairs to be done during the filling process, there are others. A list follows. A good finisher recognizes imperfections while working and, even more important, repairs them immediately. Work left for the next time is work that usually is never done.

Repair these defects as you go:

1. Ridges and gouges that often form in the area of intersecting joints.
2. Excess filler in the angles at the start of a joint being run with boxes.
3. Ridges of filler left by the box alongside the feathered edge of a joint.
4. Air bubbles and scratches in the filler.
5. Edges that are not properly feathered.
6. Lines and scratches in the angles from the angle boxes.
7. Bottoms of angles not clean and smooth.
8. Threeways with excess filler.
9. Tapes that are too long.
10. Bubbled tapes.
11. Tapes and metal that show through the filler.
12. Paper sticking out from holes left by fasteners that are pulled out.
13. Filled joints that are uneven.

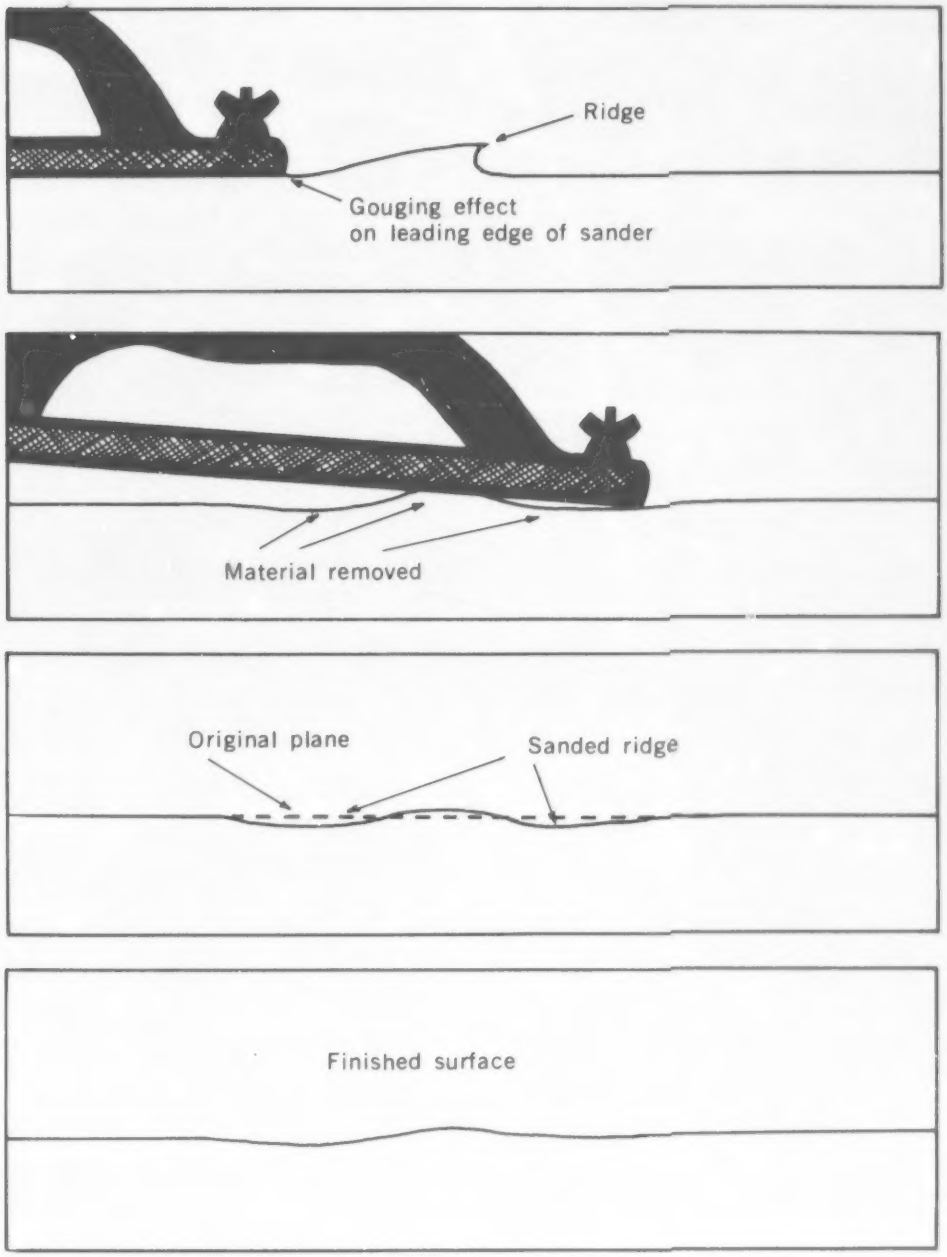
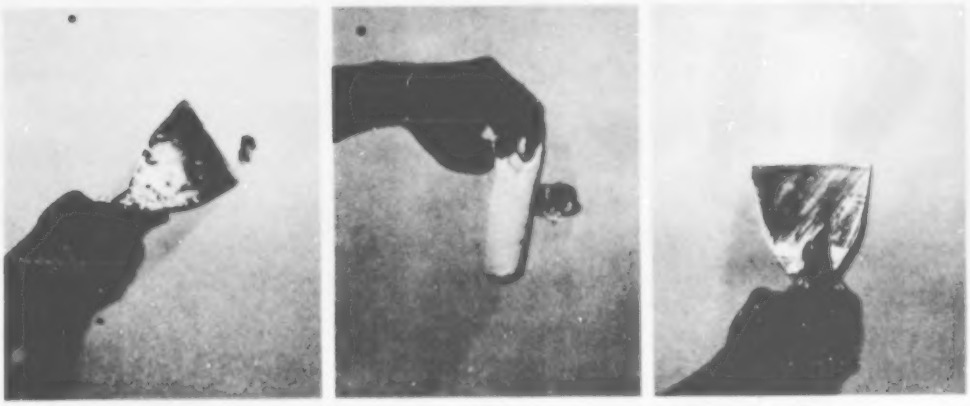


Figure 7-2
Sanding Across a Ridge Leaves Hollows in the Surface

181

Patching Holes

Drywall patches are used to make a solid backing for repairing holes. Three basic methods of patching are discussed here in terms of the size of hole each method is used to patch.



1. 2. 3.

Figure 7-3
Small Hole (2-3 cm) is Repaired with a Single Tape

Holes Less Than 8 cm

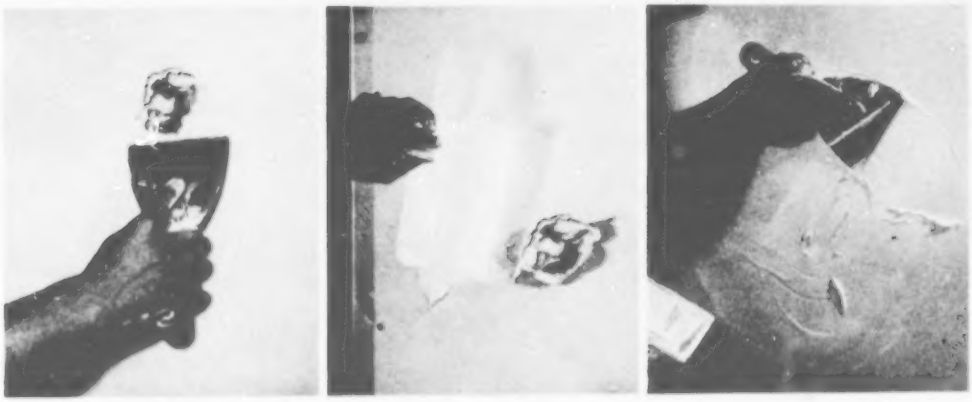
Holes that are less than 8 cm diameter can be repaired with drywall tapes, singly or laminated. Generally, the tape should extend at least 2 cm onto the solid surface around the hole to make a secure bond. Apply filler to the back of the tape before wiping the tape onto the hole (Figure 7-3). This ensures that when the tape is dry it will create a strong backing for further coats of filler. If you don't back the tape with filler but instead put filler around the hole and wipe the tape in place, there is no filler on the back of the tape and it will bubble and crack when coated. Do not fill the tape until the filler has completely dried because filling over wet tape will also cause the tape to bubble.

When the hole is large enough for more than one tape, it is best to laminate the tapes (Figure 7-4). To laminate tapes and set the patch in place:

1. Use a spot on the wall as a work surface to laminate the tapes into a patch.
2. Apply filler to the back of the first tape.
3. Overlap the second tape onto the back of the first by at least 1 cm and wipe the tapes together.
4. Add more tapes in this way until you get the desired width.

5. Coat the back of the entire patch and put it in place. Be careful not to separate the bonded tapes as cracks will result.
6. Wipe the tapes to the wallboard and feather the edges around the patch. Note in Figure 7-4 that the patch is wiped in a circular motion so that the blade runs parallel to all edges of the tape.

Note if you try to fill the hole by applying the tapes one at a time cracks will occur where the tapes overlap.



1. 2. 3.

Figure 7-4
Large Hole (6 cm) is Repaired by Laminating
Several Tapes Together

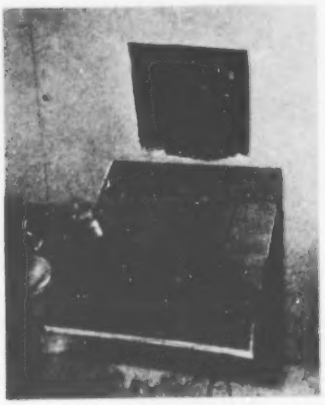
Holes From 8 to 15 cm

Laminating tapes enables you to fill holes up to 8 cm, but holes larger than 8 cm require different methods of repair to provide a more solid backing. Gluing a piece of drywall cut to fit the hole will provide suitable strength (Figure 7-5). First, square off the hole, then, starting with a piece of wallboard at least 4 cm larger on all sides than the hole, cut the back of the wallboard to the size of the hole. Snap the core along the cut and carefully peel the border core away from the face paper. This will leave a piece of wallboard that will fit into the hole with the face paper overlapping the surrounding wallboard by 4 cm.

With taping filler, coat the edges of the core of the patch as well as the back of the overlapping face paper. Place the patch in the hole being careful not to pull the face paper away from the core. This would cause the paper to bubble. Wipe the paper as you would a tape. The filler on the edges of the board and on the back of the face paper will make a secure bond. Then feather the edges of the face paper to produce a circular fill around the patch.

1.

2.



3.

4.

5.

6.

Figure 7-5
Applying a Wallboard Patch to
a 13 cm Hole

Holes Larger Than 15 cm

Holes larger than 15 cm require the fastening of a new piece of wallboard to secure backing, either the existing studs or improvised backing. One method is to cut the hole on each side back to the studs. The patch can thus be nailed or screwed to the studs.

If enlarging the hole will create problems, for example, when the framing members are on 600 mm centres, the hole can be squared and pieces of scrap backing material inserted through the hole and screwed to the wallboard. Screw a piece of scrap metal or wood stud one-and-one-half times the length of the hole to the back of the wallboard on each side of the hole as shown in Figure 7-6. Then cut a piece of wallboard to the size of the hole and screw it to the improvised backing. Note that screws must be used as the backing is not strong enough to withstand nailing.

A combination of these two methods can also be used, i.e., an existing stud on one side of the hole and improvised backing on the other side.

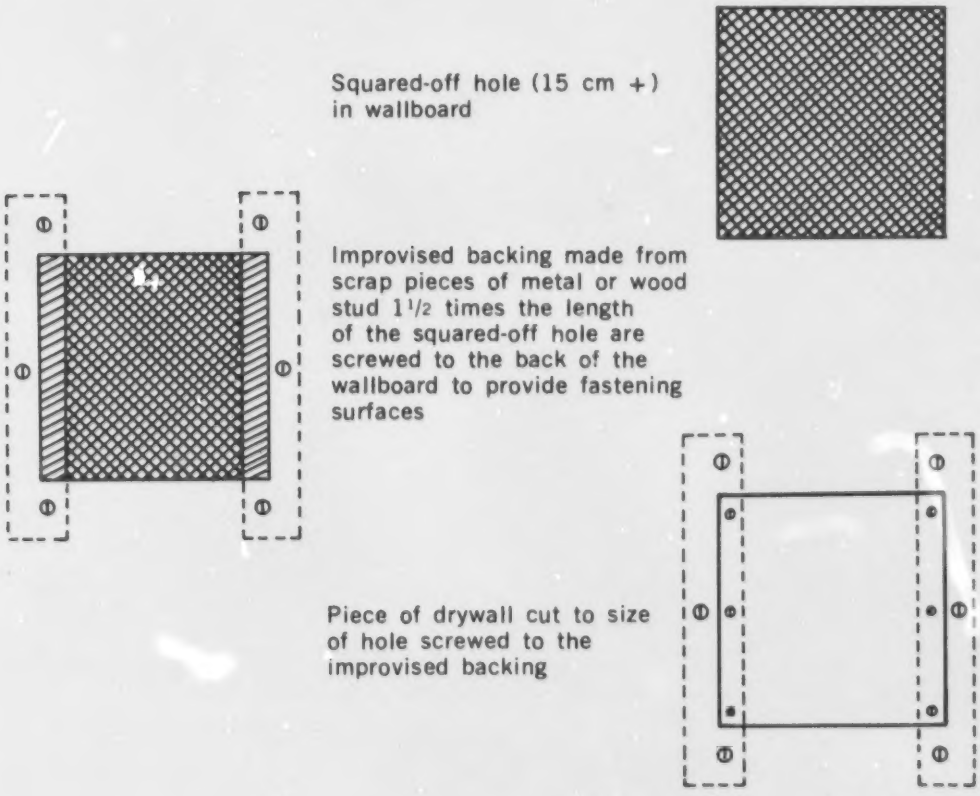

Squared-off hole (15 cm +) in wallboard
Improvised backing made from scrap pieces of metal or wood stud 1 1/2 times the length of the squared-off hole are screwed to the back of the wallboard to provide fastening surfaces
Piece of drywall cut to size of hole screwed to the improvised backing

Figure 7-6
Applying a Wallboard Patch to Improvised Backing

Holes should be patched according to their size. Trying to fill a large hole with tapes not only will be difficult but also will not give the necessary strength. Using a wallboard patch for a small hole is not practical; it may be stronger, but the time taken to properly cut it will not be efficiently spent.

Keying Painted Surfaces

Fillers must have a rough surface to which to bond. Wallboard with its woven paper surface meets this requirement, but painted surfaces encountered when making repairs do not. Painted surfaces, even those with a flat or dull finish, are too smooth for good adhesion or bonding of the filler. If filler is placed on such a surface the filler will dry and bond internally, but it will not bond well to the painted surface.

Roughing up a surface is known as keying and can be done in two ways: mechanical and chemical. Mechanical keying is scoring or scratching the surface. If properly done, the surface will have a dull look. The most common method of keying fairly clean painted surfaces is to sand the paint with coarse-grit paper. Paint is very hard once dry, thus it is unlikely that you will be able to sand through the paint to the wallboard below. As long as the surface is not shiny and there are sanding scratches in the paint, you will get a bond with the filler. If sandpaper is not handy, scratching of the surface in a close crisscross pattern will give the same effect. Be careful though not to cut the surface of the wallboard when doing this as it will cause cracking in the finish. The wall should be dusted clean before the filling begins.

Chemical treatment of painted wallboard will also produce a keyed surface with good bonding ability. Tri-sodium phosphate (TSP) is available at any paint store in a crystal form. It is a caustic solution once mixed with water, and therefore your eyes and skin should be protected from it. TSP can be applied with a sponge mop over a large surface and rinsed off according to instructions on the container. If it is not rinsed off, the residue of the TSP may react with the filler creating a chemical reaction that destroys the bond of the filler. When used properly, the surface will turn dull and lose its shine. It is best to allow the wall to dry after the rinse so that the binder in the filler is not diluted on contact with the wall. Dilution of the binder may cause a poor bond.

Chemical keying of a wall is best when the surface to be repaired is in a building that has been occupied for more than six months. Residues from cooking, smoking, or contact with oils or greases may have built-up particularly in kitchens, dining rooms, and areas that come in contact with hands. These surfaces should all be keyed chemically. Sanding will scuff the surface and leave it rough, but grease or oil residues will not be rubbed off and a poor bond will result.

Repairing Previously Finished Wallboard

Usually, you are directed to specific areas for repair on the previously finished wallboard. These may include hollow areas around fasteners and beads, ridged joints, nail pops, gouges in the wall, and cracks. You may also be called on to repair water or fire damaged wallboard.

Hollow Areas

Hollow areas are caused by filler shrinking. Shrunken filler results from movement of the framing members, or delayed shrinkage in the framing. Both are caused by excessive moisture in the building at the time of taping and filling. It is best to wait at

least six months to a year to repair hollows so that the shrinking process is complete.

To repair hollows the surface need only be keyed and three coats of filler applied the same as for filling new wallboard. It will be impossible to apply the first coat of filler without tiny air bubbles appearing in the surface of the filler. Because the wallboard surface is sealed by the paint, most of the moisture cannot enter the wallboard during the drying process and must escape through the surface of the filler, thus creating pinholes. The second and third coats will fill in the pinholes. You can expect a longer drying time between coats. Make sure that filling is done on keyed surfaces.

Ridged Joints

Ridged joints can be a result of four causes. If the moisture content of the area you are filling is high, the filler in the centre of a joint will not dry properly and will decompose after 72 hours. This leaves the tape loose in the centre. As successive coats are applied, the tape lifts and causes a ridge. If gaps in joints were not pre-filled the tape will not be bonded to a solid surface and will ridge when coated. Another cause is if the board was applied to wet framing members, the members will shrink as the building settles, forcing the boards together and the tape out. It is also possible that the edge of the board was damaged in handling or in manufacture leaving loose paper that ridges when coated.

A ridge should be checked with the handle of a knife for loose material before repairing it. Run the handle of the knife down the ridge, and if the knife does not leave a trough then the backing is solid. It is only necessary to key the surface and refill the joint as with a butt joint. If the knife leaves a trough, the tape is loose and must be cut out and filled with fast-set before retaping. Retaping the joint without removing the ridged tape will not solve the problem because there is no solid material behind.

Nail Pops, Loose Filler, Gouges

Nail pops are usually caused by shrinkage of wood studs. As the wood shrinks, it pulls away from the back of the wallboard and leaves a gap of up to 3 mm. When the wall is moved by pressure on it, or by vibration, the fastener is forced through the wallboard. Other causes of nail pops are soft studs, the wallboard was not pushed tight to the studs when fastened, and the fastener had poor holding power. To repair nail pops, simply push the wallboard tight to the framing member, tighten the fastener or apply a new one, and refill.

Similar in appearance to nail pops, loose filler or filler fallen away from the fastener is caused by the wood being too dry when the wallboard is installed. Normal moisture content is 8 to 14 per cent. As wood takes on moisture it expands, applying pressure to the back of the wallboard and forcing it away from the fastener. In such cases, the filler loosens or falls off the head of the fastener and looks very much like a nail pop. There is no point in tightening the fastener because the head may have been pulled through the surface paper and have lost its holding power. A new fastener should be placed within 5 cm of the defective one and both fasteners filled.

Gouges are a common repair item. If the paper has not been torn or bruised, fill the gouge with three coats of filler. It is important to fill only the gouge as the surrounding wall is probably flat. Scrape each coat flush with the surrounding surface. On the other hand, if the gouge is deeper than the surface paper on the wallboard, key the surface, tape the gouge and fill it. If the paper is bruised cut out the loose paper and tape and fill the exposed core.

Cracks

Cracking can occur if a joint is not taped before filling, if the tape is dry — that is has no filler under it — or if the building settles. Any break in the surface of the wallboard must be taped. Even on a steel-stud non-bearing wall, an untaped joint will crack from vibration or pressure on the wall. Two straight parallel cracks the width of a tape apart indicate a lifted tape. Tapes with cracks caused by structural stress will have a rough jagged crack. Angles also may crack and buckle from stress and the tape will become loose.

Corner beads may crack as the result of poor fastening or structural movement. A straight line crack along the edge of the bead will indicate a poorly applied bead that has bowed.

Jagged cracks along the edge of a bead indicate movement of the framing members behind it. Corner beads are made from a thin-gauge metal. If nailed to a piece of wood and the wood starts to twist or shrink, the bead will move with it.

In cases of cracked tapes, the tape for the entire length of the crack must be removed. It is necessary to remove only enough filler around the tape so that a new tape can be wiped in. The filler along the tape should be tapered so that there is no sharp edge to shear the new filler. The only area then to be refilled is the area from which the tape came, making the repair less time-consuming. When repairing cracks caused by structural movement it may be necessary to pre-fill any gaps between the adjoining sheets of wallboard.

A cracked bead resulting from improper application can be refastened, the crack taped, and the bead filled again. To refasten the bead, a fastener must be applied above and below the crack before applying a fastener(s) in the middle of the cracked area. If you fasten the middle first, the bead may warp further up and cause a longer crack. When the one side is securely fastened, check the opposite side of the bead for cracks from bowing of the flange on that side. Note that cracked J-bead cannot be fastened as it is used where there is no backing. When a J-bead cracks, it is caused by movement of the building or bumping of the bead. The only remedy is to tape the bead for its entire length and refill. J-beads generally do not bow.

Water Damaged and Fire Damaged Wallboard

Water damage occurs mostly on ceilings. Wet wallboard is pliable and bends fairly easily. When it dries it will become rigid again but the bend will still be there. It is impossible to straighten the bend unless the wallboard is made wet again, but even then there is no guarantee the wallboard will be as straight as before. The best method of repair for warped, water damaged board is to cut the damaged portion of the board out and replace it with a new section.

Fire damaged board in most cases is scorched, causing the water in the gypsum to evaporate and the core to become powdery. In this state the wallboard looses its strength and should be replaced. If the wallboard has only been exposed to smoke, the board will not usually be damaged and will only require a good cleaning.

Repairing Damaged Plaster

There are two basic types of damage to plaster — pieces of plaster that have fallen away from the lath, and hairline cracks. Drywall materials have a high pH or are basic

while gypsum and plaster materials have a low pH or are acidic. When repairing plaster the first coat should be with a fast-setting filler because the fast-set acts as a buffer between the plaster and the slow-setting filler used for the second coat. While keying the surface, check for paint bubbles or loose paint and sand if necessary.

Before starting repairs, check the surface for bulges. Bulges may be a defect in the framing of the wall, or they may have resulted from the plaster coming loose from the lath. If the bulge is caused by defective framing, filling may be necessary to level the wall. If the plaster is loose, it should be removed. After taking out the loose plaster, undercut the edges of the surrounding solid plaster as shown in Figure 7-7 making sure to remove all loose particles and dust.

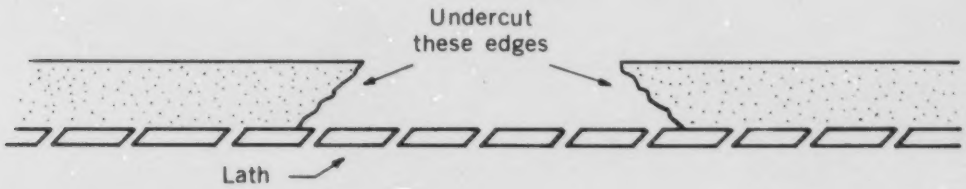


Figure 7-7
Preparing Plaster for Repair

Areas less than 15 cm in diameter should be filled with fast-set and the edges taped. The undercutting of the edges will trap the fast-set and securely hold it so that it will not fall out. For areas that are larger than 15 cm in diameter, it is best to insert a piece of wallboard and fasten it to the lath or studs. The wallboard should be as close as possible to the thickness of the plaster to make filling easier. Gaps around the wallboard and plaster should be pre-filled. The joints then must be taped and filled.

Cracks in the plaster surface should be checked for loose material, then pre-filled and taped. It is not necessary to undercut the edges on small cracks, but larger cracks should be undercut. Hairline cracks can be taped after the surface has been keyed. The biggest problem in repairing cracks in plaster is that you never seem to get all of them taped. Use a good lighting source to shine light across the wall to reveal the cracks. Be prepared to slow down when taping to make sure you catch the majority of cracks. Gouges should be treated like cracks if they are more than 3 mm deep.

Repairing Damaged Textures

Because textures are a finished decorative surface, they are the most difficult to repair. Not only is it necessary to match the type of texture, but you also must match the pattern, color, and density. Moreover, since textures are the final decoration, the building is usually occupied when repairs are made and this makes it necessary to mask off walls and cupboards, and protect floor and furniture in the room. Clean work is essential.

Before repairs can begin on damaged texture, you must determine what type of damage has been done. Abrasion damage is common to soft textures, and is caused by

something rubbing against the surface. The aggregate may have fallen off or a tape may have lifted. In either case the texture should be scraped back as far as necessary to permit repairs to the joints. While scraping, bear in mind that textures will not hide ridges or scratches. To prevent the repair job from looking repaired, scrape the texture so that the edges are feathered, as shown in Figure 7-8. By feathering the edges you can easily blend the overspray into the old texture. Large repair jobs on texture are easiest with a hand-held hopper and compressor. Smaller jobs can be repaired with a commercial patching tool.

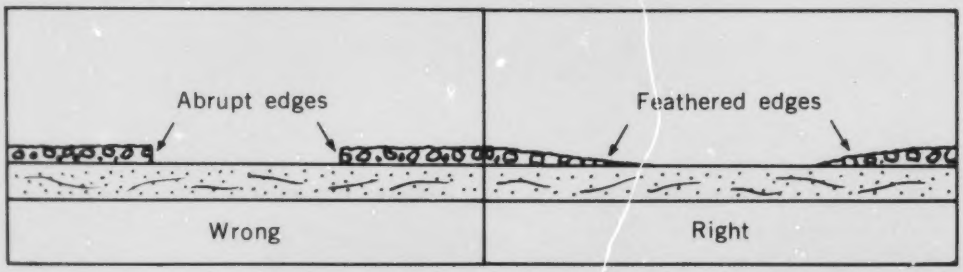


Figure 7-8
Feather the Edges Prior to Repairing Texture

Fire damaged texture that is repairable usually has some scorch marks or is darkened by smoke. Either of these defects require that the surface be sealed and painted before it can be re-textured. To get a good seal, the material must dry quickly. Latex paints and oil paints are not satisfactory for sealing because they stay wet long enough for the stain to bleed through. Instead use a polyvinyl alcohol (PVA) sealer. It dries fast, seals the surface of the stain, and provides a good base for paint. The paint is necessary because the PVA seals the stain but does not hide it. Note that there are one-coat paints available that will seal the stain and also make it white. The drawback is that these paints are very volatile and must be used in well-ventilated areas. Also the applicator must wear a respirator approved for toxic vapors.

Water stains require a very fast drying material. PVA does not dry fast enough to seal water stains and they will bleed through. Use lacquer or similar material and have good ventilation. After the seal has dried, apply a coat of paint. It may also be necessary to re-texture.

"Photographing" or "flashing joints" is generally caused by poor sealing of the surface of the wallboard before the surface was textured. If joints show through after texturing you must repaint the ceiling. When repainting soft textures, the paint must be sprayed because a roller will remove the aggregate from the ceiling. Hard textures may be done with a long haired roller.

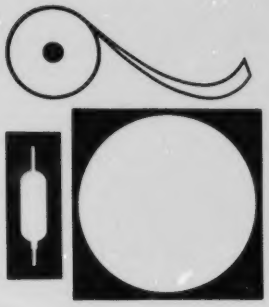
SUMMARY

- Repairs to filling defects should be done while the filler is wet so that shrinkage will be uniform.
- When making repairs to filler that is still wet, make sure the blade is wet with fresh filler or water.

- Always move the blade parallel to the scratch or ridge that you are trying to remove.
- Tape may be used to repair holes up to 8 cm diameter. Glued wallboard patches can be used for holes up to 15 cm diameter. Holes larger than 15 cm need to have backing installed and a piece of wallboard screwed to the backing.
- Recently painted surfaces may be keyed by sanding or scoring the surface. Older painted surfaces or greasy surfaces should be chemically keyed.
- Cracked tapes should be removed before repair work is started. Cracked beads must be securely fastened before refilling.
- Shrunken filler may be refilled after the surface is keyed. Hollows generally take three coats to finish.
- If ridged tape is firm it need only be filled, but if it is loose it should be removed and new tape applied.
- With nail pops or loose filler around fasteners, either refasten the existing fastener or if that is not adequate apply a new fastener.
- Water damaged and fire damaged wallboard needs to be replaced.
- Fast-set should be used as the first coat when repairing exposed plaster. Cracks in plaster may be pre-filled and taped. Ridged joints should be cut out, pre-filled and retaped.
- Large holes in plaster should be patched with wallboard, then taped and filled.
- Texture used to repair a ceiling must be the same as that originally used. Texture must blend smoothly with surrounding texture. Abrasion damage must be re-textured. Stain damage may be sealed and painted if no abrasion exists.

EXERCISE

1. What is the advantage of making repairs while filler is still wet?
2. Why is it necessary to use fresh filler when making repairs in wet filler?
3. True or False? If you are careful, you can sand out a ridge.
4. How would you repair a 5 cm hole? A 12 cm hole? A 20 cm hole?
5. Why is keying necessary when making repairs to painted surfaces?
6. True or False? All ridged joints can be repaired by refilling.
7. What is the procedure for repairing nail pops?
8. Why is fast-set used as the first coat when repairing exposed plaster?
9. How would you decide to scrape a textured ceiling or to simply repaint it?
10. When scraping damaged texture the edges of the scraped area should be _____.
11. What is supposed to happen when you apply sealer to a stained surface?
12. What does a finisher use (1) PVA and (2) lacquer for?
13. What defects can a bulging plaster wall indicate?



Factors Affecting Drywall Finishing

MODULE 8

INTRODUCTION

Even though taping and filling are the visible results of a drywall finisher's work, they reflect only about one-third of the knowledge the finisher must have. A finisher must also know the materials needed for the job, what they are made of, what characteristics they possess and what applications they are suitable for. The finisher must be able to recognize when a surface is ready to work on, and be aware of types of decoration that may be applied to the finished wall. Equally important, the finisher must have a general knowledge of the work that is done before and after the taping and filling in order to understand and be able to correct problems that arise with drywall.

Finish Schedules

A finish schedule is a description of what is to be done to a surface. Finishing schedules are important to drywall finishers because the work that they do on a wall or ceiling is dependent on the finish that will eventually go on the surface. The finish schedule accompanies the blueprints and is often divided into sections. It always refers to the blueprints in terms of the location of the surfaces. Abbreviations are used to describe finishes and structures.

Although it is impossible to discuss a general finish schedule because architects use many types, there are, however, certain conventions or basic rules that apply to most finish schedules. Finish schedules have four headings: rooms, floors, walls, ceilings. Note that with architectural charts such as finish schedules you should carefully read the headings and labels; they are there for a good reason and are important in finding the information you need.

Room Identifiers

Rooms are given by name or number; or, in a project with many rooms of similar size and shape, they are given a compass point location in the building. If the rooms are referred to by compass point you must know how the building sits in relation to the compass points.

The floor plan in Figure 8-1 shows the rooms most commonly found in a house. If the rooms were to be identified by compass point, the direction indicator on the right-hand side would be used as a reference point. For example, bedroom number 1 would be indicated as the northwest bedroom, and bedroom 2 the southwest.

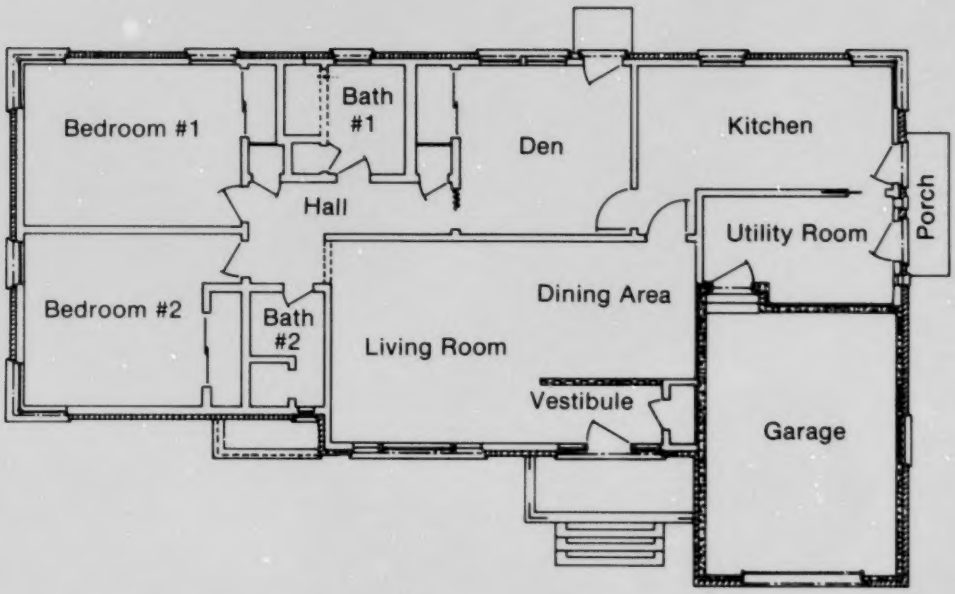


Figure 8-1
Floor Plan

How Close to the Floor to Finish

The floor schedule shows what kind of finish is on the floor. This indicates to the drywall finisher how close to the floor to finish. Generally, tiled or vinyl floors must be finished within 6 mm of the floor. Carpet, depending on its thickness, may not require the finish to be so low. There should be a heading under walls and floors, or perhaps a separate section labelled "base." This will indicate how high up the wall, starting at floor level, that a wood or vinyl trim goes. A main effect that the base has on finishing is whether or not the bottom nails or screws should be finish-coated, left with one coat, or even coated at all. Note however, that joints and beads should always be finished to the floor to prevent moldings from distorting.

The absence or presence of a base has other effects. There may be imperfections in the board along the bottom; if a base trim is to be put on, these do not need to be taped and filled. Depending if there is a base or not, the beveled edge of the board at the bottom of the wall may have to be filled along the perimeter of the room to make a uniform surface. Or if there is too wide a gap at the bottom of the wall, it may have to be taped and filled. It is important for finishers to know what work is necessary so that it can be done with the rest and not as an afterthought.

Finishing for Paint, Wallpaper and Texture

The architectural section on walls is naturally the most important to the drywall finisher, since it specifies whether the walls are to be painted, textured, or wallpapered. This information readily determines the number of coats needed to finish the wall. The

section on ceiling finish is equally important in the ordering of material and machinery, as well as in determining the amount of labour.

Once the type of decoration has been determined, you must decide on the amount of work that is needed to prepare the surface for it. Basically, the more light that a decoration reflects, the more need for careful attention in the finishing process. High-gloss and semi-gloss paints of a light color reflect the most of all finishes. If light hits an imperfection such as a scratch or a ridge on a gloss painted surface, it will not bounce off the wall at the same angle as it does off the flat parts of the surface (Figure 8-2). The light from the imperfection angles off in another direction making the imperfection appear to the eye as a dark spot or shadow in the finish. Thus finishers must minimize imperfections when preparing wallboard for gloss paints.

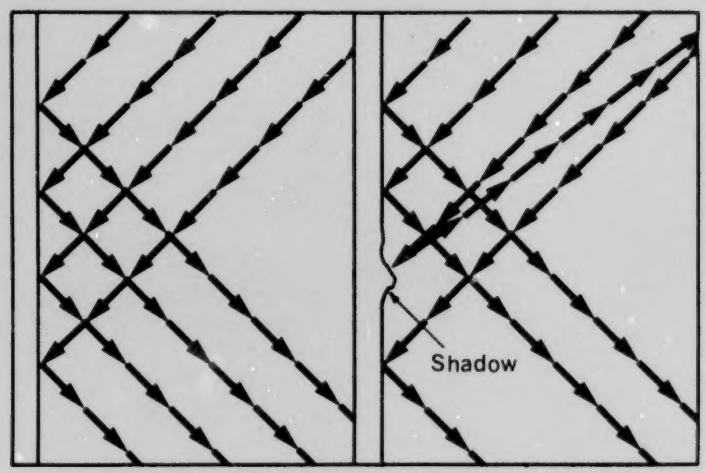


Figure 8-2

Another concern when highly reflective finishes are applied to wallboard is the difference in texture between the part of the wallboard coated with filler and the part that is not. To eliminate this concern it is necessary to skim the entire surface of the board, thus equalizing the texture over the whole surface. This will give the wall even suction, causing the paint to dry the same color.

An eggshell finish is the same texture as the shell of an egg. It reflects almost as much light as gloss paints, and therefore requires a treatment similar to that of gloss paints. It may not be necessary to skim the wall, but the joints should be given a third coat of filler to smooth them out and remove minute imperfections.

Flat paint is the best for hiding small flaws such as waves and scratches because it reflects light to a much lesser degree than other paint finishes, and because it has coarse pigment and is usually applied thicker than the others. Usually, tape and two coats of filler on flats and three on bead and fasteners is sufficient preparation for flat paints.

The placement of light fixtures can play an important part in exposing defects, regardless of the reflective quality of the paint. Lights positioned so they shine across a wall or ceiling create shadows similar to those made by a light used to check a finishing job for defects. A small bulb can make minor imperfections appear major. In places where lights shine across a wall or ceiling, the surface must be treated the same as for a high gloss finish. Extreme care must be used when sanding as even fine lines from the sand paper will appear as deep gouges.

Wall coverings come in many textures and thicknesses. The thicker the paper or vinyl and the rougher the texture, the more it will cover. For example, a heavy vinyl paper with a weave finish covers most everything and the surface need only be flat and smooth with one coat on the flats and two on the beads. On the other hand, foil paper shows as many imperfections as a high-gloss paint. The wall should be treated the same as for the high-gloss paint to eliminate imperfections that will cause ripples or bumps on the surface of the paper.

The rule applying to preparation of wallboard for textures is similar to that applying to wallpaper: the rougher the texture the greater the hiding power. Splatter textures require the same finish as flat paints. Rough textures with a loose aggregate will require a flat surface with no scratches or ridges. Self-priming textures with polystyrene aggregate will cover almost all imperfections except for deep gouges or high ridges.

Examples of Finishing Schedules

At the back of this module there are four common examples of finishing schedules. Refer to these schedules as you read the following discussions on them.

Finishing Schedule: Example 1

This schedule has five major headings. The information is indicated by the black dot under the heading. The rooms are given a name and number. "Vest." refers to vestibule or entrance way. "Rm" is room and "attend." means attendants. The only problem here is that you will have to search the blueprints to find the rooms marked with the same numbers as on the finish schedule.

The flooring will be a low-profile type, that is, it will not be raised much above the sub floor level. This could mean that the bottom of the wall will have to be finished. The wall section is subdivided into three parts. There is to be a base trim; all rooms are to have a rubber base, which comes in widths of 60 mm and 100 mm. This means that the bottom nails will not need to be done and that any imperfections along the base will be covered. By knowing this and not giving extra attention to the bottoms, you will save a lot of time and money for yourself or your employer.

The "dado" is the lower part of a wall defined by a different color or material. The walls in Example 1 do not have a dado, so it is of no concern. The "field" is the section of the wall that will be decorated. In this case, all but one room will have painted walls. However, this does not help very much because it does not state what type of paint is to be used. Without knowing the type of paint, you cannot determine the number of coats of filler required in preparation for the paint. There is a similar problem with the ceiling. It is not stated whether the acoustic ceiling is texture spray or tile, and the type of paint is not given. These factors could have been explained in the "Notes" but for some reason were omitted. Before you can complete the finish, you must know this in-

formation. You can tape and put on the first coat, but you will have to know what the finish is before putting on the second coat.

Finishing Schedule: Example 2

Example 2 is different from Example 1 in that the information is laid out in more specific areas. The same headings are used but they are major headings which makes the information easier to find. The rooms are named and numbered but there is no mention of whether the rooms can be found by looking up the numbers on the blueprints. You may have to look for the names, or simply know what area is being discussed.

Again, the information for each room is indicated by black dots in the appropriate squares. This schedule is easier to understand if it is read room-by-room. The vestibule will have a quarry-tile base, which should be at least 150 mm high. It will also have vinyl paper up to the 1350 mm mark, although this does not help much because the thickness on the texture of the vinyl is not given. The ceiling is textured, but the type of texture is not stated. The women's lavatory is tiled up to the 2100 mm mark; thus any wallboard below that mark will be hidden and require less work. Again, the type of paint to be used is left out and, for that matter, whether the walls are to be painted or textured.

Finishing Schedule: Example 3

Example 3 is a little trickier because you must first be familiar with the key. The key defines the abbreviations used under the basic headings. This schedule is more complete, providing more of the information required for the drywall finisher to complete the job. The vestibule in this case has a terrazzo floor with a terrazzo base. The base will extend up the wall for at least 100 mm. It will have a dado of 79 mm of clear vinyl plastic, with the rest of the wall being done in gloss paint. This kind of finish means extra work to get the wall smooth and blemish-free. Note that there seems to be some confusion about the ceiling, as it is unlikely that the acoustic tile will be painted with gloss paint.

These three examples lack information that is vital to the finishing process. In such cases you must refer to the blueprints or to the written specifications for additional information.

Finishing Schedule: Example 4

Example 4 combines written information and abbreviations. The written method potentially allows the architect to give more of the details needed by the finisher. The manager's office, for example, will have carpet on the floor, with a 100 mm vinyl base. Two of the walls will be covered with vinyl, which means that the walls will not have to be finished to the floor, but the rest of the walls may have to be finished for paint. The ceiling in the office will be acoustic tile, so it is of no concern to the drywall finisher other than its height. It is always safe to assume that the full height of the wall must be finished regardless of the height of the ceiling. This is done for fire protection.

Blueprint Written Specifications

With every set of blueprints there will be a set of written specifications that tell how the work must be done and under what conditions. You have to look through the

specifications to find those pertaining to drywall, since usually they are not set apart from the others. These requirements must be rigidly adhered to because they state the desired quality of workmanship. Any aspect of the job that does not meet the specifications can be rejected. Changes in brand names of material must have the approval of the architect. The architect can be a strong deciding factor in whether you and the company get paid for the job.

Note that it is a good idea to check the written specifications against the national, regional and local building codes, as well as the product manufacturer's specifications. Inquire about any differences before starting the job.

The following specifications relevant to drywall finishers are described in detail in the written specifications.

Examination of the framing that receives the wallboard or the wallboard surface that is to be taped and filled:

By starting a job you indicate that you accept the framing and wallboard surfaces and therefore must assume responsibility for correcting problems resulting from them. This is why it is important that you know what good framing and wallboard application look like. Similarily, finishers should know what completed electrical and plumbing work look like because these should be installed before the finishing begins.

Delivery and storage:

Materials should be delivered to the job undamaged, and stored in such a manner that they will stay that way.

Protection:

The specifications describe the materials you must protect from damage while your work is progressing. For the drywall finisher this usually includes everything in the building.

Environmental conditions:

These are perhaps the most overlooked yet the most important factors influencing the finished drywall product. This section outlines in detail the minimum drying temperatures and times required.

Materials:

The specifications give information concerning all the materials from the board fasteners to tape and filler, including the accepted minimum standards for the materials. It is here that brand names of materials are found.

Application of wallboard:

This should refer to National Building Code minimum standards for applying wallboard.

Control joints:

The specifications describe control joints stating where they should be placed and how they should be finished.

Trims:

The specifications describe where and what types of trims are to be used.

Joint finishing:

The specifications give the basic requirements of a taped and filled joint, and a description of what the finished job should look like.

Clean-up:

The specifications identify the clean-up that you are responsible for, and what to do with the waste material.

Moisture Content in Wood Framing and Wallboard

Moisture content is a factor in framing since most lumber used in framing is not kiln-dried. Wood shrinks as it gives off water and expands as it absorbs water. This expansion and contraction is one cause of nail pops in wood-frame buildings. If the nails are driven into the wood when it is wet, they will remain at the same level on the surface of the board, but the wood will shrink when it dries, leaving a gap between the surface of the wood and the back of the board. The board then becomes loose and the nail will be pushed toward the surface, causing the nail to pop through the filler covering it.

Moisture in lumber also causes delayed shrinkage in the filler. If dry board is put over wet lumber, moisture is confined in the lumber. The moisture has nowhere to go but through the board. As the board absorbs the moisture it becomes damp and does not allow the filler to dry completely. The filler does not finish drying and shrinking until long after the building is completed and the heat has dried everything out. Also, the wet lumber may twist as it dries, causing bulges in the board and, in severe cases, cracking the surface of the board. Note that delayed shrinkage of filler similar to that caused by wet wood framing can also occur when wallboard is applied directly to concrete.

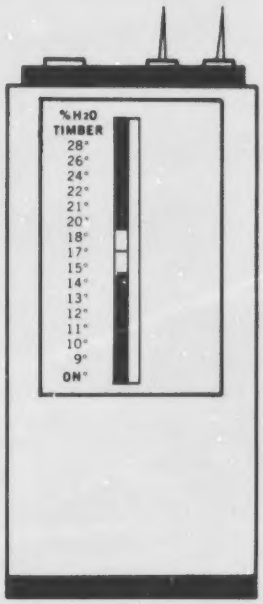


Figure 8-3
Wood Moisture Meter

206

When gypsum wallboard is being made, approximately 4 kg of water per square metre is driven off in the drying process. It is possible that the same amount of water can be absorbed back into the core of the board under very damp conditions. If this should occur, the drying process of filler will be extended considerably.

To measure the moisture content of wood and wallboard, use a wood moisture metre (Figure 8-3). It has two prongs that are pushed into the surface of the wood or wallboard. These prongs should be inserted as far as they can go to ensure that you are not getting just a surface reading. Readings should be taken at the edges and the middle of the material to get an average of the moisture content. The moisture content of studs at boarding time should not be more than 15%, and the moisture content of wallboard at taping also not more than 15%. Be careful not to let the prongs contact metal.

Moisture meters work on the principle that water conducts electricity. A battery supplies the power to the prongs. When activated, the current flows from one prong through the moisture to complete the circuit to the other prong. The flow of the electricity is then measured by a meter and shown on a scale graduated in percentages. The more water or moisture present the greater the flow of electricity and the higher the reading on the scale.

If a moisture meter is not available there are several ways of telling if wallboard has a high moisture content. Damp board can be felt with your hands. The surface will feel cold, and when your hand is run over the surface you will feel a slight pull or resistance. Also, the paper will have a spongy touch to it. Another indication of damp board is when you drive a fastener through the board into a framing member it will go deeper than normal, without cutting the paper.

To get an acceptable moisture content in wood studs and wallboard, heat and ventilation should be applied to a building at least 72 hours before the wallboard goes up, and not have been turned off more than 24 hours before taping is started.

Proper Drying Conditions For Filler

Temperature and Humidity

Because filling compounds must be mixed with water and allowed to dry, two of the most important variables in the finishing process are temperature and humidity. Temperature refers to the presence or the lack of heat. Humidity is expressed in terms of relative humidity, that is, the amount of water vapor present in the air compared with the greatest amount possible at the same temperature. Relative humidity (RH) is always expressed in percentages. It is measured with a sling psychrometer.

It is important to note that temperature and humidity cause the majority of all wallboard problems. This fact is slowly being recognized by the industry largely because of expensive callbacks to correct temperature and humidity-related wallboard problems.

Relative humidity is directly related to heat. Since warm air can hold more moisture than cold air, the higher the temperature the greater the amount of moisture that is absorbed (Figure 8-4). For example on a very foggy day on the coast, the humidity may be as high as 98 per cent. As the temperature rises the fog disappears because the air absorbs the water droplets suspended in the air. The same process occurs when you

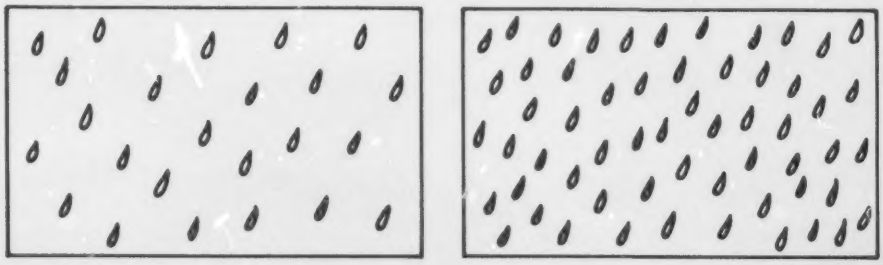


Figure 8-4
Relative Humidity

are trying to dry filler: the heat in the room absorbs the moisutre in the filler. The temperature must be kept constant if fast, uniform drying is to occur. If the temperature drops, the drying process is slowed. This could result in drying conditions in which the surface of the filler is dry but, owing to the drop in temperature, the moisture under the dry filler does not have a chance to vaporize. Conversely, if the temperature rises too high, the filler could lose adhesion and fail to bond properly due to too rapid a loss of moisture.

In general the ideal temperature for drying filler is between 12°C and 18°C. The temperature should not fluctuate more than + or − 4° during the drying period. This applies to both fast-setting and slow-setting fillers. The ideal relative humidity for drying the filler is between 40 and 70 per cent.

Note that these temperatures and humidity figures are general. When working with a specific filler, check the manufacturer's recommended temperatures and humidities for proper drying of their product. They have researched the effects of different temperatures and humidities, and they guarantee performance under the recommended conditions. If the filler is used under conditions other than those specified by the manufacturer, the finisher must take responsibility for any defects. For information on what happens to filler under various conditions, refer to Module 1, Filling Compounds, and to the drying chart at the back of this module.

Filler Drying Times

A main concern of drywall finishers is drying times of fillers. Drying times are calculated according to the temperature and relative humidity in the building. (This assumes adequate ventilation.) Charts are available that give filler drying times for different temperatures and humidities. Study the chart in Figure 8-6 at the end of this module to learn what the drying times are in relation to various temperatures and humidities. Since you are not likely to measure the temperature with a thermometer and the humidity with a sling psychrometer, train yourself to be aware of the approximate temperatures and humidities. A general rule for humidity is that when the weather is cold, damp, and rainy the humidity is high, and when it is hot and dry, the humidity is low. Some radio stations give humidity readings in their weather forecasts.

Note that in wood-frame houses with basements, two relative humdity conditions will be found. The upper wood-framed part of the house will have a low relative humidity because the heat is directed to the top of the house and the moisture in the framing members is readily evaporated. The basement, on the other hand, is constructed of concrete that will retain water, thus raising the relative humidity. Moreover, heat will not be directed into the basement, which means that the temperature will be low, further increasing the relative humdity.

Ventilation

There is a common misconception that heat is all that is necessary for proper drying. Equally important to heat in drying is ventilation.

Without ventilation, heat is of limited value because water will evaporate until the air becomes saturated, then the drying process will stop. If air is to move through a building there must be two openings — one for the air to enter, the other for the air to escape. The general rule is the larger the area to be ventilated, the larger the openings. On most jobs ventilation can be accomplished by having a combination of doors and windows open at least 5 cm. If it is a dry, warm day tne ventilation should be increased to provide better drying conditions.

Most general contractors like to have their buildings secured, which means having any possible access to the building locked tight. Ground-floor windows can be locked in an open position with pieces of wood or metal preventing them from being opened further from the outside. Buildings not having windows that open must have circulating fans to move air around. In such a building, especially large ones, circulation of the air plus some form of temporary heat will be required for drying.

Checking For Inspection Slip-Ups

Every building must undergo some inspections, whether it is residential or commercial, single dwelling or highrise. The forms of inspection will vary from district to district, so you must make yourself aware of local inspection procedures. The most common inspections relate to electrical, plumbing, framing, and insulation work. The basis of most inspections will be the National Building Code, but local regulations will often supersede these regulations, so make yourself aware of them as well. Your primary concern is whether the basic inspections have been completed, and if so whether the work has passed inspection. Inspectors check only for the quality of the work to ensure that it meets the regulations. A basic inspection card states the name of the district and the permit number of the job. It also states what has been inspected and has a section for remarks, acceptance or rejection, and the inspector's signature.

While most inspections should be completed satisfactorily, it is not uncommon for some things to be missed. The information here is not intended to make you a professional inspector, but rather to make you aware of all the things that if not checked beforehand can cause expensive problems later on.

Electrical Work

All electrical outlets should be in place by the time you start your pre-job inspection. Because they are put in place before the wiring is installed, it is wise to check that all outlets have wires running to them. Not all the boxes will be electrical, since telephone and cable-television companies install their own outlets. These outlets do not have a

back on the box since they provide support only for the finishing cover. Switches are generally located beside a door inside a room. They are usually 150 mm from the floor. Every room should have a light receptacle and a switch, except for living rooms and bedrooms, which can have switch-controlled outlets. Switches and outlets in kitchens should be 20 cm to 30 cm from the top of the counter. Wall receptacles are usually placed 20 cm from the floor. Electrical conduit is the only method of installing wires outside the walls. Make sure that all electrical conduit feeds into a box and that no loose wires are exposed.

Except in kitchens, bathrooms, laundry rooms, water-closet rooms, utility rooms and hallways, wall outlets should be installed in every finished room or area in a dwelling so that no point along the floor line of any useable wall space is more than 1.8 m from an outlet in the same room. The rooms excepted from this code should have as many outlets as needed with at least two in the kitchen. Generally speaking, bathrooms have a light switch and receptacle, an electric shaver outlet, and an outlet which is connected to a no-fault breaker switch.

Wires for thermostats are usually located centrally in the hallway where the average temperature of the area can be monitored. They are usually 150 cm from the floor. The wires are different colors and are not attached to one another. Doorbell wires are similar and are usually placed in the same area but higher on the wall. Electric and hot water heat may have thermostats in every room.

If you find that wires are missing or that common electrical installations are not present, check with the person in charge of the site.

Plumbing

Plumbing may be found inside the walls in bathrooms and kitchens. Hot and cold water pipes and a drain are necessary for hooking up a sink or bathtub. If the pipes are in the wall, make sure that the fixture connections stick out beyond the surface of the wallboard so that they will not be accidentally covered. The bathtub must be in place before the board is put on the wall. Plumbing pipes that concern the drywaller are: hot and cold water supply pipes, the drain pipes for plumbing fixtures and the location of the shower arm. It is a good idea to have a short piece of pipe screwed in the shower arm connection extending beyond the wallboard to show the exact location of the arm. Another concern about the plumbing is to make sure that no pipes touch the back of the wallboard. If they do, the wallboard may bulge so have the plumber correct this problem.

Framing

Drywall is applied to two basic types of framing: wood construction and steel construction. Problems can arise with both types of framing. Without going into details of the actual framing, it is possible to recognize the problems and how they can be corrected. Drywall finishers will not often get the apportunity to examine framing, but they should be aware how framing can affect their work.

Once boarding begins, it means that the framing is accepted as satisfactory. The person boarding then becomes responsible for any defects in the framing that affect the finish of the board. This practice is common to all the trades involved in construction. By doing a thorough job of inspecting the framing, in addition to the work of other trades, liability in producing an acceptable finished surface is reduced.

The first step is to check the blueprints and make sure that all the walls shown have been put into the building. Check the measurements of stub walls, openings, doors, archways, etc., the locations of stairs and the design and dimensions of unusually shaped drops. When certain that all measurements are correct, check the walls with a straightedge. The longer the straightedge the better because it will make inconsistencies more obvious. Studs that do not conform to the rest of the wall should be marked, and a carpenter should be called back to either replace or straighten them. Also, the fastening surface of the framing member should be in line with the bottom and top plate. Twisted studs should be replaced since they do not allow the fasteners sufficient depth to grip securely.

The plumb of the wall refers to the vertical angle of the wall to the ceiling and floor. The quickest way to tell if a wall is plumb is to put a level on it. A wall that is out of plumb will be most noticeable where the entire length of the wall can be seen from one end. When walls are out of plumb, notify the superintendent of the job that you will not be held responsible for the appearance of the wall after the wallboard is on. Get this in writing because verbal agreements are not always remembered.

Although wallboard is a fairly rigid material, it is susceptible to warping. For this reason the maximum distance between the centers of wall studs should be 400 mm for 9.5 mm board, and 600 mm for 12.7 mm and 15.9 mm board. Ceiling framing should be 400 mm centers for 12.7 mm board and 600 mm for 15.9 mm board. If ceilings are to be textured, 15.9 mm board is strongly recommended to prevent sagging.

All framing members to which the board will be attached must be a minimum of 38 mm wide. This ensures that proper support will be given to the board by providing an adequate surface area of contact between it and the framing member. All joints in the board except flat joints should have backing material to nail to. This ensures that the board will not move and cause the joint to crack. When checking backing, look at the corners and angles to make sure the board can be fastened on either wall. If proper backing is not present make sure it is put in before boarding starts. External corners around archways, drops, and valances must be framed to meet requirements and be rigid enough to accept the fasteners that will be used in applying the board.

If wood trim is to be used around windows, check to be sure that the door and window frames have been left so that the surface of the board will be flush with the edge of the frame. If L-bead is to be used around windows in conjunction with a wood liner, be sure that the board will lie on top of the liner.

Wood Studs

When inspecting wood studs, check the soundness of the wood. If the wood is too soft, have the stud replaced because the fasteners will not hold the wallboard securely to it. All studs must be firm. In interior angles, wood studs should be placed to form and L-shape so that there is enough bracing to fasten the ends of the board to each side. External corners must be framed with three studs to provide proper backing for both sides of the wall. All openings should be framed with double studs and headers.

One of the main problems in wood framing is that the structure of drops, valances, and other enclosures are often not sturdy enough. The minimum size required for framing in such areas is 38 mm × 38 mm. This supplies the necessary rigidity as well as making the structure less susceptible to movement and cracks in the finish. If plywood is used for backing it should be a minimum thickness of 12.7 mm so that it is thick

enough for fasteners to securely hold the board.

If you have to straighten a wooden stud yourself, cut a wedge out of the edge of the stud that sticks out beyond the plane of the wall (Figure 8-5). The cut should be at least halfway through the stud. The edge that is sticking out should be pushed back till it is level, and pieces of scrap lumber nailed on both sides to keep it in place. Another method is to cut the back side of a bowed stud (Figure 8-5) and drive a wedge into the sawcut. When the stud is straight nail pieces of scrap lumber onto both sides of the stud.

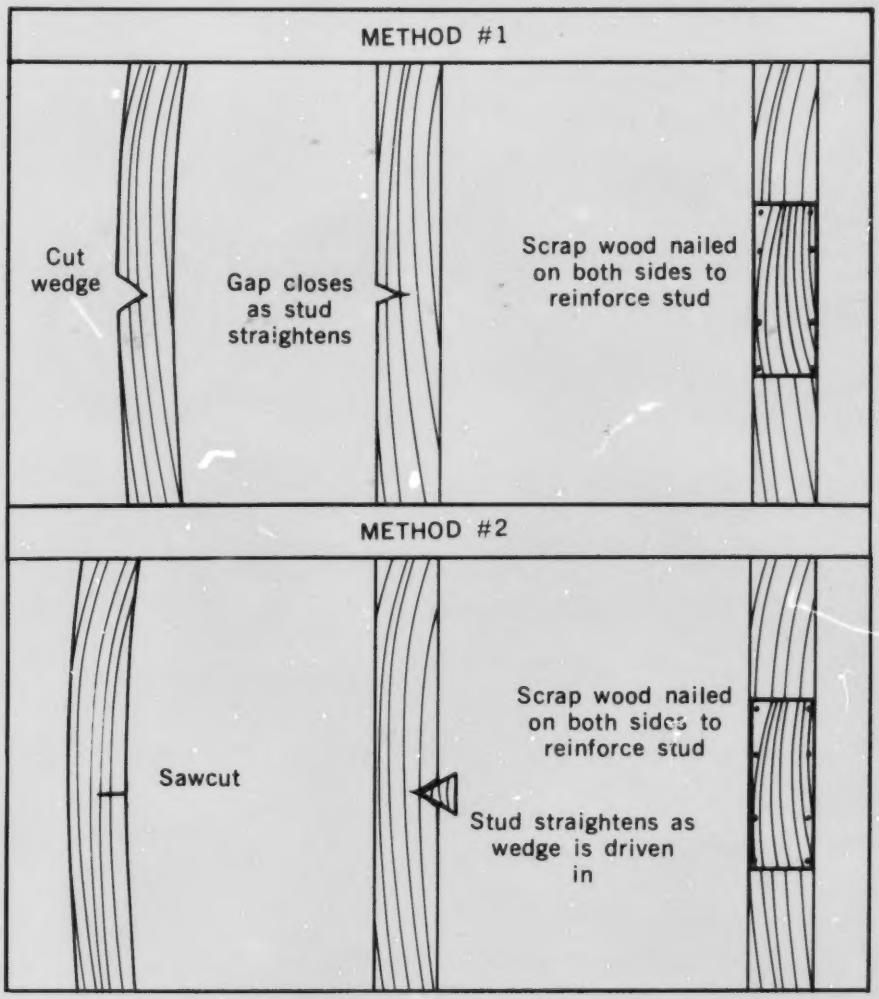

METHOD #1
Cut wedge
Gap closes as stud straightens
Scrap wood nailed on both sides to reinforce stud
METHOD #2
Sawcut
Scrap wood nailed on both sides to reinforce stud
Stud straightens as wedge is driven in

Figure 8-5
Wood Stud Repair

Steel Studs

The steel studs discussed here are those in non-load bearing walls. When checking this type of framing, you must make certain that the walls are not attached to load-bearing structures. The wall must consist of a steel track attached to the floor and another one attached to the ceiling. Steel studs should be screwed or clinched into position at either end of the stud so they will not move. The door openings must be framed so that the metal door channel easily slides into place. The frame must be able to be fastened at any point along its length. Check for the size of the doors to be used. If the doors are to have wood frames, pieces of 2.5 cm × 10 cm wood must be attached to the inside of the framed door area. Allowances must be made in the framing to allow for inclusion of the wood.

A steel stud seldom will be out of place, but when it is, the cause is either that the channel was not laid down properly or that someone kicked a stud out of place. To repair a track that is out of place is a major operation. A stud that is bent or loose must be replaced or screwed back into position. Both these repair jobs require special tools that the drywall finisher does not usually carry. The need for repairs should be brought to the attention of the steel-stud installer so that they will be done properly.

Steel studs have knock-outs that allow wiring and other services to pass through them without affecting the strength of the stud. These must be aligned so that the services can pass through easily and continuously.

Wallboard

Wallboard may be applied either horizontally or vertically. Horizontal application is preferred for the following reasons:

1. It is more economical as longer sheets can be used.
2. It reduces lineal footage of joint treatment by 25 per cent, thus cutting labor and material costs.
3. More framing members can be tied together per panel.
4. It gives greater coverage of irregularities in framing.
5. Joints on walls are at a convenient height for finishing.
6. The board is easier to handle.

Vertical application is preferred where the ceiling is higher than the standard 2 400 mm or where the wall is narrower than 1 200 mm.

Butt joints should be staggered and placed as far as possible from the centre of a wall or ceiling. The greatest amount of movement will occur in the centre of a room, and a butt joint will not accept much movement without cracking or buckling. Butt joints in the middle of a room are also more noticeable if filled incorrectly since they are the center of the field of vision when entering a room. Butt joints should always be fastened at a framing member and run parallel to the framing. There should be no floating joints except flats between the studs.

Fasteners should be driven in so that they hold the board securely in place, and the paper surrounding the fastener should not be broken. Fasteners should be no closer than 5 mm to an edge of the board. Nails must be spaced every 18 cm on ceilings and every 20 cm along vertical wall supports. Double nails may be spaced 5 cm apart every 30 cm. If screws are being used they must be placed every 30 cm on vertical supports

or ceilings. The nails must be long enough to penetrate the wood 3.5 cm whereas the screws must be long enough to penetrate the support at least 3 cm.

Lamination of two layers of board provides a stronger wall, better sound-proofing, and greater fire protection; it also means that there are fewer fasteners to fill. The first layer is nailed or screwed on in the normal way and the second layer is fastened in place with an adhesive, with the joints running opposite to those in the first layer. Double-headed nails are normally used to hold the board in place until the adhesive dries or sets, and are then removed.

Beads and moldings should be on tight. There should be no ripples in the flange of the bead and no kinks in the finishing edge of the bead. Ripples can be re-fastened but any bead with kinks must be removed so that the finish of the bead will not be affected. Bead that has been removed should not be used again because the metal will stretch and it is impossible to put it back on straight. Joints in bead should be tight and level. If they are not tight and level they should be taken off and replaced. Paper bead should have no bubbles.

Some of the problems finishers can find with the boarding are: spaces between joints, rippled beads, fastener heads above the surface of the board, uneven joints, broken core, loose face paper, improper joints (i.e., floating butt joints), cracked face paper, gouges, oversized holes for outlets and pipes.

Method of Taping and Filling

The method of taping must be decided prior to starting the job. The size of the job will dictate the methods of taping and filling. Is the job small enough for one person to do in one day by drytaping? Will it need two workers to use the hopper method to tape and load in one day? Or will three workers and a taping machine be needed? Essentially, you need enough work at a job-site to be able to complete a coat in one day. One person should be able to drytape 350 to 450 m^2 of board per day. Two should be able to tape 2240 m^2 per day with a hopper, while three could tape 3150 m^2 with a taping machine. Machine taping may be faster than the hopper method but cleanup is longer. Machine-filling is faster than hand-filling, but again the cleanup is longer. Renting or buying machines is costly, so you must determine whether the size of the job warrants the expense.

Whatever method is to be used, it is essential that the necessary tools be on the job-site. They should be clean and in good working condition so that no time is lost making repairs or adjustments.

Stilts enable the average-sized person to easily reach a height of 2.4 m. But they should not be used when the height of your feet will be more than 60 cm from the ground. For room heights greater than 2.4 m, the use of ladders or scaffolds should be considered. Although ladders are easily moved, they permit only small areas to be covered between moves. A small rolling scaffold is good for manoeuvrability where the floor is level and clean to permit its free movement. But it is not practical for areas where your feet will be higher than 1.5 m from the ground as it becomes very unstable above that height. Where the floor of the working area must be higher than 1.5 m, a wider-based scaffolding should be used. Check Workers' Compensation Board regulations for proper erection and safety aspects of scaffolds.

Wherever scaffolds are used, make sure there are a least two persons present for the duration of the work. This is important to safety as well as to efficiency because the

material can be passed to the higher level without excessive travelling. The person at the lower level can also help in moving the scaffolds. It is important that all necessary material be present to build the scaffold, and that the scaffold be ready for the workers when they arrive on the job.

Handling and Storage of Materials

Storage of material is another factor that can make a difference not only in the quality of the finished product, but also in the amount of work needed to finish the job.

Wallboard is a finished product and should be treated with the same care given to millwork or pre-finished wood panelling. The better the condition of the board before it is put on the wall the better the finish that can be achieved. The gypsum core of the board is brittle and breaks if handled roughly. Broken board is useless for a finishing panel as the internal strength of the board affects the adhesion of the paper on the surface. It is essential that the bond between the core and the paper be maintained.

Wallboard should always be carried on its edge. Carrying it flat causes bending, which reduces the strength of the core, especially if the surface paper is cracked. Two persons should carry a sheet of gypsum board to reduce the risk of banging the edges and corners, and to save strain on one person moving it. The board should be held so that both handlers are on the same side, with the board resting against the shoulder of the arm carrying the weight. It must be set down in such a way that neither the edge or corners will not be crushed. Although the board will withstand a drop of a few centimetres on a long edge without damage, it should not be dropped on a corner or the core will shatter. Once the edge has been set down, the board can be gently laid flat with the face side up. To prevent nails and small rocks from marring the surface, the last sheet to go on the pile should be face down. Board should be stored flat in a dry place, and in an area of the building where it will not have to be moved except to be put on the wall. It should be away from major traffic areas so that it is not walked on. Make sure the edges of the board don't overhang to avoid breakage should they be stepped on.

Wallboard is highly susceptible to moisture. High-humidity areas must be avoided to ensure that the board will remain dry. It should not be laid on a bare concrete floor but rather on a vapor barrier, such as a polyethylene sheet, so that the moisture in the concrete will not be absorbed by the board. An alternative method is to place pieces of material called dunnage to form a platform. The dunnage should be at least 10 cm wide, be no more than 40 cm apart and should not be more than 7 cm shorter than the width of the board. This method is also recommended for storing board on uneven surfaces. Board should not be stacked more than 1 m high to avoid warping. It may be placed temporarily on edge by leaning it against a wall, but prolonged storage this way will also cause it to warp. If board must be leaned against a wall make sure the wall requires no other work to be done on it, because the more the board is moved the more likely it will be damaged. The temperature in the building at the time of loading should not be lower than the temperature of normal working conditions, 12°C.

Powdered filler is another material that is highly susceptible to moisture. If it becomes damp it will form lumps in the bag and become impossible to mix. Like the board, filler should be stored in a warm, dry place, and raised off concrete flooring. Premix filler can withstand one freeze-thaw cycle, although it is not a good idea.

Although metal bead is not greatly affected by temperature, it should not be left in a moist place very long. Even though the metal has been galvanized it may rust under ex-

treme moisture conditions. Metal bead should be stored where it will not come in contact with oil or grease, and where it will not be walked on or bent. It should be stored flat, since propping it against the wall could cause it to warp. Remember, once corner bead is bent the metal stretches and it becomes impossible to put it on straight.

To limit damage to any material, it should not be delivered too far in advance of its use and should be left in the original protective wrapping until it is needed. This ensures that it will remain clean and in good condition.

Stains on wallboard are a problem. Virtually any material that is a different color than the surface of the wallboard and that is soft or water-solvent will cause a problem in the finishing of drywall. Some of the more common staining materials are coffee, blood, rust, ink, and chalk-line marks. These stains will be dissolved by the water in the fillers and textures and will blead through the surface of the covering unless they are first treated properly. Oil and latex paints are not suitable treatment because they take so long to dry and allow the stain to soak. Lacquer or one of the spray-bomb varathane plastics are best as coatings for stains because of their fast drying qualities.

Protecting Nearby Surfaces

The adage "an ounce of prevention is worth a pound of cure" applies to the protection of surfaces adjacent to wallboard. At the stage when drywall finishing is done, most of the materials surrounding the drywall are finishing materials and must be protected from wet filler, texture, and dust. Wet filler is much easier to clean than dry filler. Filler will always leave a white film on porous substances such as brick and concrete blocks. Filler on unfinished wood will leave a dark area when the wood is stained as the filler absorbs more stain than does the surrounding wood. Some textures contain a latex-base paint to whiten them and provide better coverage. When this paint dries on a surface, it is impossible to remove without some damage. Some textures contain sand or perlite and when wiped off a surface, even when wet, they may scratch it. Because these damages are the fault of the drywall finisher, liability for damage or the replacement of the damaged material falls on the drywall finisher.

There are many ways to cover areas that require protection. Small areas such as door jams, window frames, and brick can be protected with masking tape. The tape must be as tight to the gyproc as possible to prevent the filler from leaking under the tape and onto the protected surface. Before removing the tape, run a knife along the edge of the tape to separate the filler on the tape from the filler on the board. If this isn't done the tape will pull off chips of filler from the wallboard.

Masking tape sticks only to clean, dry surfaces. It is useless to try to stick masking tape to mortar or to a dusty surface. Although the tape will adhere to the particles of sand or dust, the particles will not be secured to the rest of the surface and the tape will be ineffective protection. It may help to wipe the area with a dry, clean cloth to improve the bond. Note also that masking tape will not stick to wet filler.

Do not leave masking tape on the protected surface any longer than is necessary because it can damage the surface by removing part of the finish. On pre-finished heat registers the paint may peel off with the tape if it is left on too long. Generally speaking the wider the masking tape the greater your concern should be for the finish of the surface it is protecting. Note that if tape dries out it must be removed with a cleaning solvent thus creating more problems. Avoid putting tape at all on photo-finish panelling and on the paper face of wallboard, since it will damage both of these surfaces.

When an area larger than the width of the masking tape needs to be protected, a masking machine may be used in conjunction with a paper apron. When areas such as doors, windows, or brick work are to be protected, a polyethylene sheet may be more efficient.

Poly is excellent for covering floors or furniture when ceilings are being textured, but only if it will be walked on for a short time. A tarpaulin is the best protection for a main traffic area. A tarp is expensive, but it can be used many times and won't slide on the floor and cause possible injury from falls. Although it is almost impossible to fully protect areas from dust caused by sanding filler because it is so fine, poly is probably the best material to use as it is a non-porous substance and dust cannot pass through it. Use masking tape to seal the edges.

To prevent dust from entering the duct work of the building, cover the heating outlets and intakes. If possible shut off the circulating devices. Before doing either of these, however, first check with the superintendent to see that damage cannot be done to the system. Open the windows for ventilation. Dust control is important because dust, once it gets into the duct work, circulates throughout the building for a considerable time after the job is finished.

SUMMARY

Job Inspection Checklist

General

1. Has the previous trade work been inspected and did it pass local inspection requirements?
2. Did previous trades make a proper clean-up after completing their work?
3. Is there anything in the blueprints, the architect's specifications, or the finish schedule pertaining to the finishing of walls and ceilings?
4. Do all electrical outlets have wires running to them and are there wires in all the electrical conduits?
5. Are there any wires for thermostats and door bells?
6. Has the necessary plumbing been completed?
7. Have the necessary materials been delivered, and if so do they meet specifications?

Framing

8. Are the walls straight and plumb?
9. Are there any obstructions sticking out beyond the plane of the nailing surface?
10. Has all the necessary framing around duct work and pipes been done?
11. Are studs a maximum of 400 mm centres for 9.5 mm board and 600 mm centres for 12.7 mm and 15.9 mm board?
12. Are all framing members straight with a level fastening surface?
13. Are all framing members a minimum of 38 mm wide?
14. Have all door and window frames allowed for the wallboard to be applied?

Wood Studs

15. Are there three studs at all vertical corners?
16. Is there backing on both sides of interior angles?
17. Are all openings in walls framed with double studs and headers?
18. Are any wood studs too soft to securely hold nails or screws and keep the wallboard tight?
19. Is the structure rigid enough for nails?

Steel Studs

20. Are all steel studs securely fastened to the track, and is the track securely fastened to the floor and ceiling?
21. Are all steel stud walls free from any load?
22. Are door locations framed so that the doors will fit easily and properly?
23. Are the holes in the steel studs aligned so that electrical wires and plumbing can pass through easily and continuously?
24. If wooden door frames are to be used, has wood been applied to the steel studs so that the frames may be nailed in?

Masking Areas to be Protected

25. Are there any areas that have to be protected from wet filler or sanding dust?
26. Will masking tape, paper apron, polyethylene, or some other means be required for protection?

Temperature and Humidity

27. Was heat maintained at a minimum of 12°C for at least 72 hours before the board was applied?
28. Is the moisture content of the wood studs at or below the maximum of 15 per cent?
29. During application can the temperature be maintained between 12°C and 18°C with a maximum variation of + or − 4°C?
30. Can the temperature remain constant for at least 72 hours after the drywall is filled and finished?
31. Is there proper ventilation so that moisture can escape?
32. Is it understood that if temporary heat is supplied that it not be the type that uses kerosene or stove oil, and that the heater have a thermostat or other control with which to regulate the temperature?

Loading and Storing Material

33. Will any special equipment be required to load material into the building?
34. Is there a dry, level place raised from any concrete surface that the material can be stored upon?
35. Will the material be out of the way of heavy traffic areas and be protected from moisture and damage?
36. Will materials be delivered as close as possible to the time that they will be used?

Module 8

Finishing Method

37. What method of taping will be used for the most efficient application?
38. What type of filler will be used to give the best results under the prevailing conditions?
39. What type of finish is required on the ceilings?

Boarding Application

40. Does the board meet the architect's specifications?
41. Will the board be attached vertically or horizontally?
42. Will the board be laminated?
43. Have the minimum number of joints been used?
44. Are all butt joints staggered and away from the centre of the wall?
45. Are joints around openings at least 30 cm from the corners?
46. What type of fastener will be used?
47. Are all the fasteners set slightly below the surface of the board, and do they hold the board tight to the framing structure?
48. Has the requirement for distance between fasteners been met?
49. Are all joints tight with no foreign material protruding?
50. Are all joints fastened to a framing member?
51. Are all surfaces flush with no butt edges against a tapered edge?
52. Have the cold air returns for the furnace been cut out?
53. Are thermostat wires showing at the 150 cm mark?
54. Are there any doorbell wires? If so, are they showing at approximately the 210 cm level?

Beading

55. Are all the beads on tight and straight?
56. Check all joints and corners formed by the bead. Are they flush?
57. Have all electrical outlets and pipes been checked to make sure that there will be no holes surrounding them when they are finished? Does the finish schedule provide for plates?
58. Have all short tapes been applied?
59. Have all joints and beads been treated with the required number of coats to support the final decoration?
60. Have you properly cleaned up and removed excess material from the site?

Drying Chart for Joint Filler

Figure 8-6

RELATIVE HUMIDITY

TEMPERATURE °C	98%	97%	96%	95%	94%	93%	92%	91%	90%	85%	80%	70%	60%	50%	40%	30%	20%	10%	0%
40	4½D	3D	2D	42H	38H	33H	23H	18H	14H	11H	7H	6H	5H	4¼H	4H	3½H	3H	2¼H	2H
35	5D	3½D	2½D	2D	43H	39H	35H	24H	22H	17H	13H	9H	8H	6H	5¼H	5H	4¼H	4H	3¼H
30	6D	4½D	3½D	2¾D	2¼D	2D	44H	40H	36H	25H	19H	14H	10H	9H	7H	6H	5¼H	5H	4¼H
25	9D	6D	5D	4D	3¼D	2¾D	2½D	2¼D	49H	34H	27H	19H	14H	12H	10H	9H	8H	7H	6H
20	12D	9D	7D	6D	5D	4D	3½D	3¼D	3D	2D	38H	26H	20H	17H	14H	12H	11H	10H	9H
15	18D	12D	10D	8D	7D	6D	5D	4¾D	4¼D	3D	2¼D	38H	29H	24H	20H	18H	16H	14H	13H
10	26D	18D	14D	12D	10D	9D	8D	7D	6D	4D	3¼D	2¼D	42H	36H	29H	26H	23H	21H	19H
5	38D	26D	21D	17D	14D	12½D	11D	10D	9D	6D	4¾D	3½D	2½D	2D	44H	38H	34H	30H	28H
0	53D	37D	28D	25D	20D	18D	15D	14D	13D	10D	7D	4½D	3½D	33D	2¼D	2¼D	2D	42H	38H

D-days H-hours

Very good
Good
Poor
Very poor

- Board should have 15% or less moisture content before filling
- Temperature should not vary more than 8 degrees during the drying time
- Adequate ventilation should be provided to remove moisture
- Moisture content of filler should be 15% or less before it is coated again
- Drying times relevant to fast setting, casein and vinyl fillers
- Chart refers to thickness of 2-3 mm of filler. Thicker filler will take proportionately longer to dry

Room Finish Schedule
Example 1

Room		Floor			Walls						Ceiling		Notes
Name	No.	Vinyl Tile	Terr-azzo	Lino Tile	Base		Dado		Field		Field		
					Rubber	Terrazzo	Mat'l	H't	Paint	Block	Acoustic	Painted	
Dining Rm	1	•			•				•		•		
Kitchen Vest.	2		•		•				•			•	
Kitchen	3		•		•				•			•	
Snack Bar	4	•			•				•		•		
Office	5			•	•				•		•		
Baggage Rm	6	•			•					•		•	
Concessions	7		•		•				•		•		
Concessions	8		•		•				•		•		
Concessions	9		•		•				•		•		
Waiting Rm	10		•		•				•		•		
Airport Attend.	11			•	•				•			•	
			Extend Downward as Required by Number of Rooms										

The schedule is usually extended in width to include more detailed subdivisions under floors, walls, etc.

Room number should be indicated on plan thus 1

Room Finish Schedule
Example 2

No	Name	Floor					Base			Dado		Wall			Ceiling			Accessories		Remarks
		Concrete	Terrazzo	Quarry Tile	Vinyl Tile 2mm	Broadloom By Owner	Terrazzo	Quarry Tile	Vinyl	Vinyl Fabric 1340 mm	Ceramic Tile 2100 mm	Unfinished	Gypsum Board	Walnut	Texture	Gypsum Board	Acoustic Tile	Counter Cupboards	Lockers	
1	Vestibule			•				•		•			•		•					Inset Door Mat
2	Display		•				•						•				•			
3	Information Office				•				•				•				•	•		
4	Conference Room	•				•			•					•			•			
5	Cloak Room				•			•					•			•			•	
6	Projects Office				•				•				•				•			
7	Women's Lavatory		•								•		•		•					

Room Finish Schedule
Example 3

Schedule of Finishes																										
Item Number	Rooms & Areas	Floor				Walls								Ceiling				Trim				Key	
		Border		Field		Base		Dado		Field		Cornice		Border		Field		Door		Window		Symbol	Materials & Finishes
		Material	Finish	Material	Finish	Material	Finish	Material	Finish	Material	Finish	Material	Finish	Material	Finish	Material	Finish	Material	Finish	Material	Finish		
	Column Symbol	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	At	Acoustic Tile
1	Entrance vestibule, lobby, waiting rooms and corridors	To	Pd	To	Pd	To	Pd	P1	VP1	P1	PT1	—	—	—	—	At	PT1	St	PT2	A1		Cp	Cement Plaster
2	Below grade, offices, laboratory, exam room, canteen, locker room, pharmacy, pack stores, C.R., rest rooms	To	Pd	Va	Wx	To	Pd	P1	VP1	P1	PT1	—	—	—	—	At	PT1	St	PT2	A1		Ct	Ceramic Floor Tile
3	Above grade, wards	To	Pd	Hv	Wx	To	Pd	P1	VP2	P1	PT1	—	—	P1	PT1	P1	PT1	St	PT2	A1		Gt	Glazed Wall Tile
4	Utility rooms, janitor rooms	To	Pd	To	Pd	To	Pd	P1	VP1	P1	PT1	—	—	—	—	At	PT1	St	PT2	A1		Hv	Homogeneous Vinyl
5	Toilets and bathrooms	Ct	—	Ct	—	Ct	—	Gt	—	Kp	PT1	—	—	—	—	At	PT1	St	PT2	A1		Kp	Keenes Cement Plaster
6	Auditorium	Wd	Vd	Wd	Vd	Wd	Vd	P1	VP1	P1	PT1	—	—	—	—	At	PT1	St	PT2	A1		P1	Gypsum Board 12.7 m
7	Dining room	To	Pd	Hv	Wx	To	Pd	P1	VP1	P1	PT1	—	—	—	—	At	PT1	St	PT2	A1		PT1	Paint — Gloss
8	Arts and Crafts	To	Pd	Hv	Wx	To	Pd	P1	VP1	P1	PT1	—	—	—	—	At	PT1	St	PT2	A1		PT2	Paint — Enamel
9	Stairways	To	Pd	To	Pd	To	Pd	—	—	Tg	—	—	—	—	—	—	PT1	St	PT2	A1		Pd	Polished
10	Serveries	Qt	—	Qt	—	Qt	—	—	—	Gt	—	—	—	—	—	At	PT1	St	PT2	A1		Qt	Quarry Tile
11	Overhead passage	To	Pd	Hv	Wx	To	Pd	P1	VP1	P1	PT1	—	—	—	—	At	PT1	St	PT2	A1		St	Steel
																						Tg	Glazed Structural Terra Cotta
																						To	Terrazzo
																						Vd	Varnished
																						Va	Vinyl Asbestos
																						VP1	Vinyl Plastic Clear Vinyl
																						VP2	Vinyl Plastic
																						Wd	Wood Hardwood
																						Wx	Wax

Interior Finish Schedule

Example 4

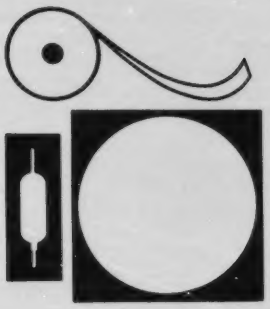
Finish 1 — 2 coats latex flat paint Finish 2 — 2 coats latex enamel Finish 3 — 2 roll coats epoxy paint

Finish 4 — Stain, 1 coat sanding sealer, 2 coats satin-finish varnish

Room	Floor	Walls Unless noted, at masonry 12.7 mm gypsum board on furring on studs 15.9 mm gypsum board	Ceiling	Base	Notes
Lobby	Floor	Vinyl wall covering on 15.9 mm gypsum board	Acoustic tile. Plaster border	10 cm vinyl at partition and wall	Finish 4 on counter shelves. Rail (detail Sh. A-4)
Secretary's area	Carpet by owner	Railing elem.: oak plywood E. wall vinyl wall cover	Acoustic tile. Plaster border	10 cm vinyl at partition and wall	Finish 4 on elem. 1 plywood
Tellers' Area	Carpet by owner	N. wall vinyl wall cover E. wall elem. 1 plywood oak	Plaster below joists. Luminous ceiling 12 mm egg crate on exposed tees.	10 cm vinyl at partition and wall	Paint 3 a/c duct collars above luminous ceiling white
Manager's office	Carpet by owner	2 walls vinyl wall cover on 15.9 mm gypsum board 2 walls 6 mm pl. glass in br. anod. alum. Flush-glazing system.	Acoustic tile	10 cm vinyl at partition and wall	
Closing Office	Carpet by owner	2 walls vinyl wall cover on 15.9 mm gypsum board. 2 walls 6 mm pl. glass in br. anod. alum. Flush-glazing system.	Acoustic tile	10 cm vinyl at partition and wall	
Workroom	Carpet by owner	Paint-finish 1	Acoustic tile exposed grid	10 cm vinyl at partition and wall	
Employee lounge	Carpet by owner	Paint-finish 1	Acoustic tile exposed grid	10 cm vinyl at partition and wall	
Men Women	Ceramic tile on cement bed	120 mm ceramic tile wain. Finish 2 above.	Acoustic tile exposed grid	Ceramic tile	
Coat closet	Carpet	Paint-finish 1	Acoustic tile exposed grid	40 cm vinyl	Hang rod 2 shelves
Janitor's closet	Vinyl asbestos tile like Armstrong imperial modern	2 walls concrete block 2 walls 15.9 mm gypsum board. Paint finish 3	Ditto-at o.w. joists	40 cm vinyl	
Storage vault	V.A.T.	Epoxy paint finish 3 on concrete block	White finish cement plaster on concrete slab. No paint	40 cm vinyl	

EXERCISE

1. What information does a drywall finisher look for on a finishing schedule?
2. What is the difference between finishing a wall for flat paint and a wall for gloss paint?
3. What effect does humidity have on filler drying time?
4. If wallboard is put on wood studs that have a high moisture content, what can be the result?
5. What is the minimum temperature for proper drying of slow setting filler?
6. Besides heat, what else is needed to dry filler?
7. Why should the temperature be fairly constant when filler is drying?
8. Name three problems that can occur with wood framing.
9. Name five problems finishers can find with the boarding.
10. What is the recommended height for stacking wallboard?
11. What is the best way to treat stains on wallboard?
12. What should you do before removing masking tape that has protected a surface from filler?
13. Where would you find the brand name of fillers to use for a job?
14. What is the maximum amount of moisture content that wood studs and wallboard should have?
15. What is the ideal humidity range for proper drying of filler?
16. Consulting the drying chart given in this module, how long would it take a coat of filler to dry when the temperature is 15°C and the relative humidity is 50%?
17. In the average bedroom, what electrical wires and boxes should be in place at the time the wallboard is being taped?



Working Efficiently

MODULE 9

INTRODUCTION

Because wages compose the bulk of the cost of drywall jobs, it is important that finishers work efficiently. This is not to say that the faster the work is done the more efficient it is. Speed must be combined with quality to make a job efficient. If the finishers are working efficiently, it follows that the employer makes money and the employees are kept working.

This module is not intended as a lesson on "getting in good with the boss" or pace setting, but rather on how important it is to keep costs down. If costs become too high because of poor employee planning, a more efficient crew may be found to complete the job.

Organizing Tools and Equipment

Depending on the size of the job, there are always certain tools or pieces of equipment required to start the job, other tools or equipment to complete the work, and still another set to clean up. These tools and pieces of equipment should be on the job before the crew gets there, and should be in good working order. It is usually the responsibility of the person in charge of the job to order equipment. This requires knowledge of what the job involves in different types of buildings, e.g., single or multiple dwellings, commercial blocks, warehouses, and what tools and equipment are required for each. For example, a commercial building with high walls may require the use of a scaffold, or a series of scaffolds to elevate an entire work floor. All frames, flooring, braces, and safety rails should be at the job site and set up on the morning of the first work day. Taping and filling machines should be in good working order. If equipment is not in good repair, the crew could be left standing around doing nothing or working on something that does not produce a finished product. Wages for lost or unproductive time add up fast. It is conceivable that a company's estimated profit for a job can be eaten up in time wasted by poor planning.

The efficient worker shows up on the job with all needed tools in good shape and in a tool box so that they can be readily located. Time spent running to a car to get a trowel or a knife costs money.

Tools and equipment should be centrally located and secured in such a way that they cannot be lost. Taping and finishing tools should be kept near the mixing area. When not in use, they should be kept in a locked room or container for insurance purposes, since insurance covers only those tools that can be proved were properly protected.

Identifying Cost-Efficient Use Of Materials

There are two ways to use materials efficiently. One is to use only the quantities that are needed for the job; the other is to use the correct types of materials. Using only the required quantities means a saving in material costs. For example, ordering corner beads in lengths that can be cut for outside corners and the excess used for headers in closets reduces waste. Ordering 2.1 m beads instead of 2.4 beads for closet returns or door openings reduces waste. For some window returns ordering 2.4 or 3 m pieces will eliminate all waste. When a long run is required, the longer the pieces of bead the less time spent in joining them.

By choosing the correct material for the job you can make savings in both materials and labor. Deep fills of more than 3 mm should be done with fast-set filler to ensure that the filler is hard enough to re-coat in minimum time; with fast-set this can be anywhere from 15 to 90 minutes. To do the same job slow-set filler can take from one to three days to dry, and then shrinkage may necessitate an extra coat to make sure the fill is level. Thus, if the proper material is used for deep fills, time is not wasted putting on an extra coat or waiting for the filler to dry.

Checking Work

Each worker on a crew is a part of a larger system and thus if individual workers are not doing their part the system as a whole will be affected.

When you are assigned a task you carry the responsibility of completing that assignment. Since most persons will miss a few spots here and there, it is a good idea to develop a habit of checking the work after completing it. The few minutes that this check will take will save time in the long run. To make the check walk around the room in the reverse direction from which you came. In this way, you view the work from an opposite angle and you will see misses and errors more easily. Remember even those who have been in the trade a long time will miss something.

Consider the result of forgetting to do a set of fasteners. It could take up to three hours to put three coats of filler on the fasteners. If someone has to stay to do this it means there is a three hour delay just for a set of fasteners. Or if someone is sent back to the job there is the three hours plus travelling time. To avoid such delays and additional costs, make a quick check of your work; it is a good safeguard.

If you are following someone else on a system where each of you does a specific task, and you notice that something was missed, it is usually more efficient to do the missed item yourself rather than waste time getting your co-worker to come back. This is not to say that you should always be covering up the mistakes of others, but rather to do so when it is within reason. If the mistakes of co-workers become frequent then you should tactfully mention the neglect to them.

The Individual Versus The Team Approach

There are two main ways for crews to approach a drywall job: the individual approach and the team approach. In the individual approach a worker does all phases of the finishing job from start to end. With the team approach a worker does one phase of the job, for example the taping.

Both approaches have their advantages and disadvantages. The individual approach tends to produce good quality work, but it can be slower because a worker is not as

practiced in each of the four phases as someone who does only one of the phases all the time, and because of the monotony created by the length of time it takes to complete the job. The team approach tends to produce faster work but the overall quality may not be as good. For the team approach it is important that the crew have a common idea of how the work should be done. Most finishers take pride in their work and can become quite discouraged when the work done before them is not up to their standards. Similar standards are most often developed amongst crews who have worked together for a while. Individual approach crews usually work best with a relatively inflexible supervisor who checks behind each worker to see that the job is complete. Team approach crews usually require a more flexible supervisor.

Finishers will have their own particular strengths and preferences. Foremen and supervisors should learn what these are to get maximum production from their work crews.

Work Systems

Different types of buildings require different work systems. Houses are often done on a four-day system. The first day is for taping and first-coating of fasteners and beads; the second is for second-coating fasteners and beads, and first-coating flats and butts and one side of the angles if the job is done by hand; the third day is for polish-coating all remaining work; the fourth day is for texturing ceilings and for sanding. It should take one day for one worker to complete one coat on an average-size house (460 m^2). If there are two or more houses side by side, the crew is usually increased and the work proceeds as follows: on day one tape and first-coat all the houses; on day two second coat the houses, and so on. In this way all the houses will be completed on the same day. Note that a coat is not started on house two until the coat has been completed on house one.

In a multiple unit building the system can be different. One system is to regard suites as separate units and work through the building unit by unit. The disadvantage of this system is that all the suites on a floor may not get finished on the same day. A more common system is to regard an entire floor as a unit of work where the crew completes one coat at one time on all suites on the floor. For example, everyone on the crew will fill bead until the floor is finished. Then the crew splits up to do the nails and flats. The work force is adjusted so that one floor is completed in one week. This system is dependent upon having reliable crew members who don't miss work days. If days are missed then this system can become inefficient and costly.

Commercial buildings, especially large shopping centres, must be divided into sections. Usually the schedule of the site is such that as one trade finishes in one section the next moves in. Therefore, it is important that the drywall contractor finishes a section on schedule so that the project is not held up.

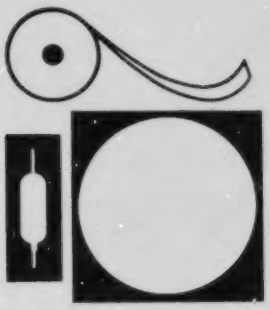
SUMMARY

- All equipment required to complete a job should be on the job site before the crew arrives.
- All equipment should be in good working order before it is delivered to the site.
- An efficient finisher develops a self-checking system to ensure that nothing is missed.
- To use materials efficiently, you have to order both the right amount and the correct type.

- There are four main phases to consider when organizing work systems for a drywall job:
  1. Tape, and first coat bead and fasteners.
  2. Second coat all fasteners, bead and tape.
  3. Polish coat.
  4. Texture ceilings and sand the walls.
- The work supervisor must consider the size and work schedule of the job to determine how many workers are needed and how large the unit of work should be.
- There are two basic approaches to doing a drywall job: the individual approach and the team approach.
- The most common way of finishing multiple unit buildings is to complete one floor at a time.

EXERCISE

1. Name three ways of saving money on a drywall finishing job.
2. What habit should a finisher develop that will minimize misses?
3. What is a suitable crew size for finishing four average size houses in one week?
4. What are the four work phases to consider when choosing a work system?
5. What is an advantage and a disadvantage of each of the following ways of organizing crews?
   - Individual approach.
   - Team approach.



Maintenance of Tools and Machines

MODULE 10

INTRODUCTION

Some people use their tools as an excuse for doing poor work. They should, however, blame themselves because they are the ones responsible for keeping their tools in good working condition. Tools that are well maintained save time and money in the long run.

Complete maintenance information for all the equipment used in the drywall industry cannot be provided here, but following are some general maintenance rules applying to most drywall tools and machines.

Maintaining Hand Tools

After use, hand tools should be cleaned and dried so that rust does not form on them. When not in use they should be stored in a locked tool box. Since most nicks and rough edges on tools occur while transporting tools, the tool box should have compartments or dividers to prevent the tools from bouncing around or coming in contact with one another.

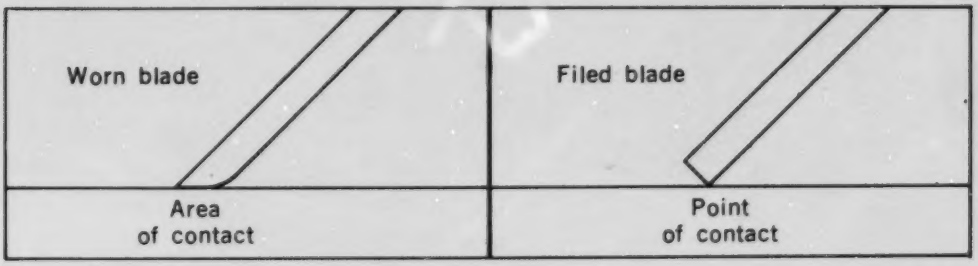


Figure 10-1
Blade Contact

Trowels and Knives

Trowels and knives should be kept square so they will cut through the filler. The more a blade is worn the greater becomes the surface area of metal that contacts the filler (Figure 10-1). This means that to compensate for the poor cutting ability of the blade, the applicator must apply more pressure. Thus more mud is removed, leaving the fill hollow. Check your work. Do your tools leave a poorly feathered edge? Do your fills always seem to be hollow? If so, you deserve a break: buy a single-cut, mill bastard file

and file the blades square on your filling tools. And how about the tapes that you wipe? Do they always seem to be too high and difficult to fill? It could be that the knife you are using has worn sharp and therefore is not pushing the tape tight to the wall.

Worn tools make your work harder and the quality poorer; they may even cost you your job. Filed tools, on the other hand, make your work easier and improve the quality of your work.

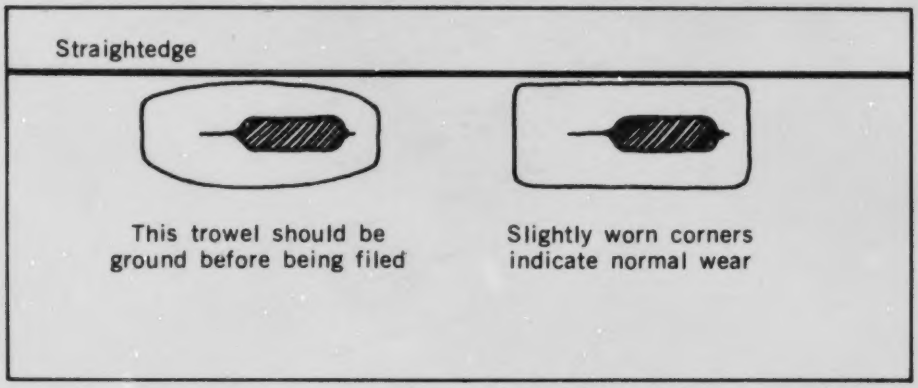


Figure 10-2
Check for Blade Straightness

Before filing the blade, check it with a straightedge to see how badly the edge is worn (Figure 10-2). If the edge is too badly worn it may be necessary to use a grinder to rough out a straight edge on the blade before filing. Run the blade through the grinder for the full length of the blade on each pass. Although the blade tends to warp as it heats up from the grinding, it returns to normal as it cools. Do not, however, heat the blade until it turns blue as this causes loss of temper resulting in quicker wear.

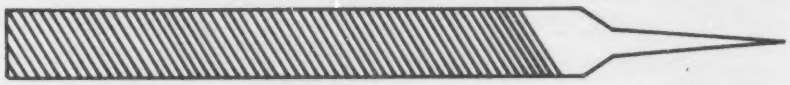
Once the blade is roughly straight, select a single-cut file (Figure 10-3) and fasten the file to a surface so that you can push the blade along the file without it moving. One way of fastening the file is to hammer nails in tight to the heel and tip of the file, then bend them over the file. Place the blade firmly on the file, keeping the blade perpendicular to the file. Press down with even pressure on the blade so that it does not skip and push forward until the pass is finished. Lift the blade straight up from the file and repeat the pass (Figure 10-4). Note that if you move the blade too fast it will rock and you will not get a straight edge.

After filing, remove any burrs with sandpaper. This applies to all trowels and knives. You should use sandpaper rather than filing off the burrs because the filing will decrease the width of the knife. By filing the blades of your tools once a week you will keep them in good condition. Besides maintaining the blades, make sure the handles of trowels and knives are on tight so they don't move while you are working.

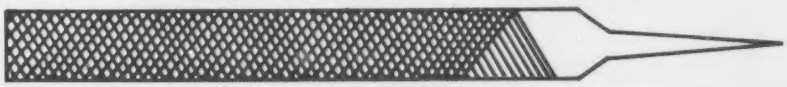
Hawks

Hawks may also be filed if they are worn. A worn hawk begins to take on a star shape.

This makes it impossible to remove all the mud from the trowel when you wipe the trowel against the hawk. Hawks may be ground with a grinder before filing, but remember that the material used in hawks is soft and a lot of it can be quickly removed.

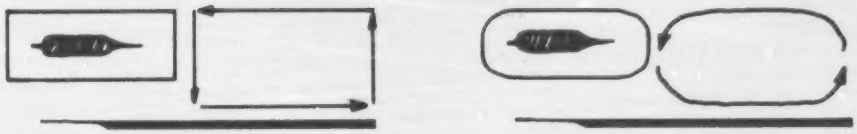


A single-cut file has only one set of cutting teeth. It leaves a smooth edge



A double-cut file removes metal faster but it leaves a rougher edge

Figure 10-3
The Right File



The way the blade is moved across the file is the shape the blade will take

Figure 10-4
Filing a Blade

Tin Snips

Tin snips become dull with use but can be sharpened. By following the instructions in Figure 10-5 you can keep them in good working order cutting the full length of the blades.

Maintaining Machines

Following are general points regarding machine maintenance:

1. Keep the inside and the outside of the machine as clean as possible. Spray the

outside of a machine with a thin oil. The oil will make washing the machine easier because filling material will not stick to it.

2. Do a routine check of hoses, filters, and fluid levels before using a machine. Routine checks make machines more reliable and last longer.
3. Make sure all electric motors have proper connectors and that all switches are in good working condition.
4. Have the following tools handy to maintain machines: pliers, flat screwdriver, Phillips screwdriver, adjustable spanner.

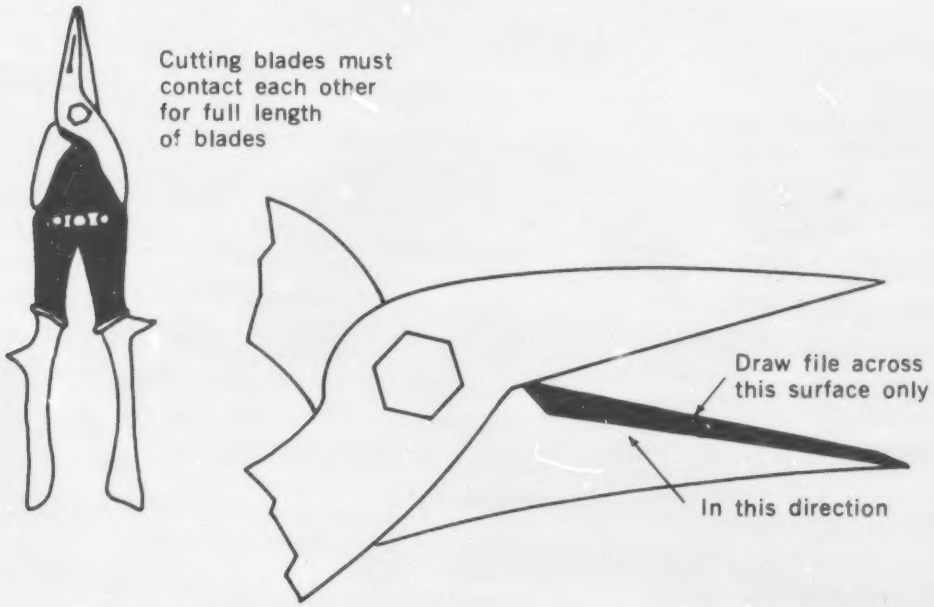


Figure 10-5
Sharpening Tin Snips

Repairing Machines

Machines used in the drywall finishing trade will occasionally need repair. Some repairs can be done on the job, whereas others will require that the machine be sent to a repair centre. Whether the repairs are done on the job will depend on several factors:

1. Is the machine leased or owned? A leased machine usually includes a service arrangement whereby a machine in need of repair can be exchanged for one in good working order. On the other hand, when a machine is owned, the owner is usually responsible for all repairs.
2. Can you make the repair faster than you can get it done at the repair centre? In many situations, the down time of the machine must be kept to a minimum.

3. How far are you from a repair centre? If you are close it may be practical to have all repairs done by the centre. However, if you are in a remote area where it could take weeks to get the machine repaired, it will be quicker to repair the machine on the job. The further you are from a repair centre, the more spare parts you should have on hand.

The potential repairs that may be required by the various drywall finishing machines are discussed here. The discussion mainly deals with those repairs that can be done on the job.

Repairing Hoppers and Banjos

Simplicity in the design of a hopper leads to very few problems with them. The only moving parts on a hopper are the gates. If filler leaks from a gate it is possible that the gate has been bent. Straighten the gate as necessary.

As with a hopper there is little that can go wrong with a banjo. Bent metal parts that require straightening are the only likely problems.

Repairing Taping Machines

On the job repairs to taping machines will depend on the availability of spare parts. Many suppliers include a small repair kit with the machine consisting of the parts that are most commonly replaced. Besides this kit, if a machine is to be repaired on the job these parts should also be kept on hand: a cutter blade chain assembly, filler valve, cable, and drive chain.

Following are the repairs to taping machines, listed in order of most common to least common, that can be done on the job. Replace the:

- Cutter blade.
- Filler valve.
- Cable.
- Feed needle.
- Drive chain.

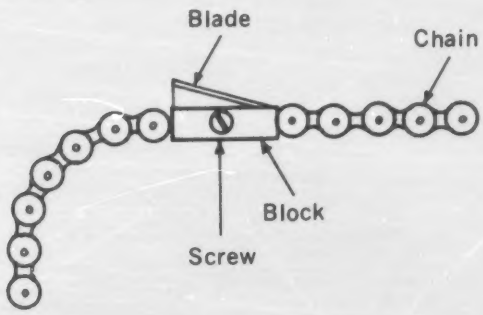


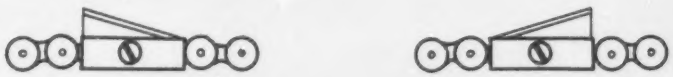
Figure 10-6
Cutter Blade

Taping machine repairs that must be done at a repair centre are:

- Worn drive wheel.
- Worn plunger.
- Leaks in the gate flap or in the joints.
- Bent tube.
- Broken casting.

Replace the Cutter Blade

There are two methods to replace a cutter blade (Figure 10-6) depending on whether the cutting blade block comes out or not.



Right Wrong

Figure 10-7
Placement of the Cutter Blade

Method One

1. Pull the cutter blade chain from the left hand side of the machine until the block holding the blade is completely out of the machine. If the block does not come out go to method two.
2. Use a nail or wedge to prevent the spring on the right hand side of the machine from pulling the cutter chain back.
3. The new blade should be with the spare parts in the bottle in the tape holder.
4. Remove the screw from the block and remove the blade.
5. Place the new blade in the block so that the blade tapers off to the right (Figure 10-7).

   Caution: The blade is very sharp. Do not push it into place with your fingers.
6. Tighten the screw.
7. Release the spring.

Method Two

If the blade does not come out:

1. Remove the cotter pin on the left hand side of the cutter chain. Note that when the cotter pin is removed, the aluminum tube will fall away from the machine.
2. Pull the chain to the right to completely remove the chain from the machine.
3. Follow procedures 3, 4, 5, and 6 in Method One.
4. Feed the chain back into the machine making sure the blade is toward the top.

5. Replace the cotter pin.

Note: At times it may be impossible to remove the screw to release the cutter blade. In this case a new chain and blade block should be put in.

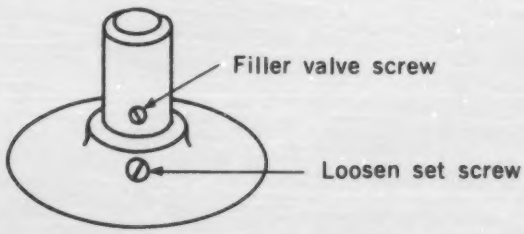


Figure 10-8
Filler Valve

Replace The Filler Valve

The filler valve should be replaced when it is bent and will not seal properly in the gooseneck, or when the valve will not seal during taping causing filler to run out of the machine.

1. Loosen the set screw on the head casting at the base of the filler valve (Figure 10-8).

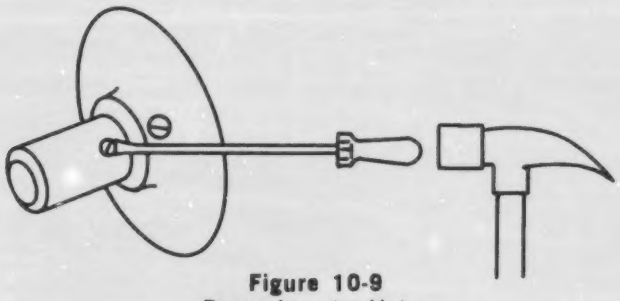


Figure 10-9
Removing the Valve

2. Using a screwdriver and a hammer, gently tap on the filler valve screw (Figure 10-9) to remove the valve from the casting.
3. Insert a new valve making sure it sits square.
4. Tap the valve with a piece of wood or plastic to seal the valve in the casting.
5. Tighten the set screw.

Replace The Cable

Replace the cable if filler will not flow onto the tape when the drive wheels are turned. However, first check these more common causes for filler not flowing onto the tape:

- The gate flap lever is not up as far as it will go.

- The plunger safety rod is not pushed back into the head.
- The winding key does not turn freely while driving the drive wheels.

1. Empty filler from the machine by pushing the piston to the top of the machine with a stick.
2. Remove the four screws that hold the cover plate in place.
3. Remove the cover plate.
4. Unwind the cable from the cable drum.
5. Remove the set screw that holds the cable in the drum and pull the cable out.
6. Remove the screws that hold the end cap in place and remove the end cap.
7. Remove the piston with either a stiff piece of wire or by shaking the machine up and down.
8. Remove the nut on top of the piston.
9. Remove the cable.
10. Unwind the spare cable from the piston.
11. Thread the new cable through the removed nut and through the slot in the bolt (Figure 10-10).
12. Place the nut on the bolt and tighten it so that the cable is secured to the piston and the brass end of the cable is beyond the nut (Figure 10-11).

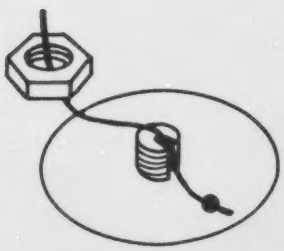


Figure 10-10
Insert New Cable

Figure 10-11
Secure the Cable to the Piston

13. Load the cable into the end of the machine and fit the piston into the tube. Be certain that the seal of the piston does not fold over.
14. Push the piston to the end of the machine.
15. Pull the cable through the head.
16. Place the brass ball on the end of the cable into the slot on the cable drum (Figure 10-12).
17. Place the retaining screw in the drum and tighten it. Test pull the cable to make sure it is secure to the drum.

18. Using a screwdriver or a piece of wood, pull the cable tight.
19. Put the gate flap lever down so the drive wheels are disengaged.
20. Wind up the cable making sure it does not twist or bind.
21. Replace the head plate. Be careful not to cross thread screws as they strip and break easily.
22. Replace the retainer cap.

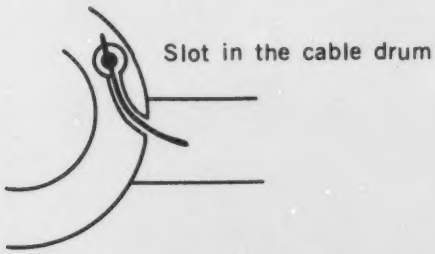


Figure 10-12
Secure the Cable to the Drum

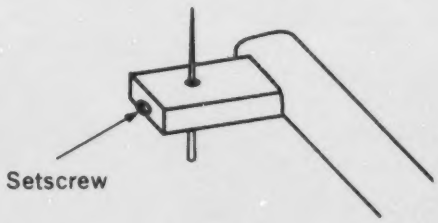


Figure 10-13
Tape Feed Needle

Replace The Tape Feed Needle

The tape feed needle is not replaced very often but it may wear down or fall out.

1. Remove the set screw (Figure 10-13).
2. Pull the needle out.
3. Take a new needle out of the bottle of spare parts.
4. Put the new needle in place and adjust it so that it penetrates through the tape with the needle at mid-point in the advance position.
5. Tighten the set screw.

Replace A Drive Chain

Extra drive chains are not normally supplied with taping machines and must be purchased separately.

To replace a drive chain:

1. Remove the chain guide.
2. Push in the locking roller spring just below the drive wheels.
3. Roll the drive wheels backward and the small chain sprocket will unscrew from the drive wheel shaft.
4. Remove the old chain and put the new one in place.
5. Put the small sprocket into the chain and place the sprocket on the shaft.
6. Roll the wheel forward until the sprocket is tight.
7. Release the locking roller spring.
8. Install the chain guide.

Repairing Angle Rollers and Flushers

Two types of rollers are available. One has metal rollers and the other plastic or nylon rollers. The metal rollers have bushings that in time wear out. The plastic rollers also have bushings that wear out, and in addition they can develop flat spots on individual rollers from the roller not turning. Repairs to rollers are done at a repair centre; they are not done on the job.

Some angle flushers are a solid piece of metal bent to a 90° angle, while others have two piece casting with springs and replaceable blades. In both cases it is recommended that the flushers be sent to a repair centre to be repaired. The degree of precision required for adjustment plus the specialized tools are not readily obtainable on the job.

Repairing Hand and Pole Sanders

There are two repairs that can be made on filling boxes on the job: the blade and the rubber seals can be replaced. All other repairs should be sent to a repair centre.

To repair the blade:

1. Force a nail under the end of the blade and pry up.
2. Pull out the blade.
3. Clean the slot with the end of the nail.
4. Turn the set screws at either end of the brass blade holder so that they will not contact the blade.
5. Check the blade for paint on one edge. The painted edge faces out. If no paint is present either edge can face out.
6. Bend both ends of the blade to form a slight S-shape. Too much of a bend will make the blade difficult to insert in the slot.
7. Place one end of the blade in the slot and work the rest of the blade into place. If necessary, use a piece of wood or plastic to tap the blade in place.
8. Adjust the blade to the proper height.

To replace the rubber seals:

1. Remove on the sides of the box the two retaining screws that hold on the back plate of the box.
2. Pull the back plate up and out.
3. Remove the rubber seals.
4. Install the new rubber seals with the tabs fitting into the slot in the back of the plate.
5. Fit the back plate in place and wet the rubber seals so they slide into the box.
6. Replace the retaining screws.

Hand and Pole Sanders

There are two wear points on sanders:

- Sandpaper clamps.
- Rubber pad.

Sandpaper clamps wear down and will eventually not hold the paper in place (Figure

10-14). To correct the worn clamp, file the edges of the clamp straight.

Figure 10-14
Worn Clamp

The rubber pads on sanders round off from use making it difficult to sand right into the corners. The pads can be replaced. Tear off the old pad completely from the base metal. Use contact cement to glue the replacement pad in place.

Repairing Airless Paint Sprayers and Texture Machines

Routine checks should be made on the fluid levels and filters of airless paint sprayers. Most repairs to the sprayers are done in repair centres, although on some sprayers repair kits are available for replacing check valves and spray tips.

Except for the replacement of orifices, all repairs to texture machines should be done at a repair centre.

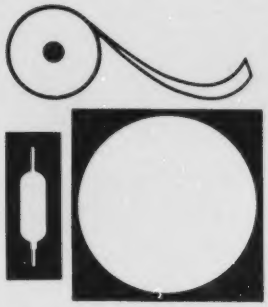
SUMMARY

- Trowels and knives should be filed straight and square.
- Prior to filing, grinders can be used to straighten a worn trowel or knife.
- Keep machines clean inside and out and in good working condition.
- Some repairs to drywall finishing machines can be done on the job while others must be sent to a repair centre.
- A bent gate is about the only thing that can go wrong with a hopper.
- These repairs can be made to taping machines on the job. Follow the correct procedures as outlined for each repair. Replace the:
  - Cutter blade.
  - Filler valve.
  - Cable.
  - Feed needle.
  - Drive chain.
- Repairs to angle rollers and flushers are done at repair centres.
- On filling boxes the blades and rubber seals can be replaced on the job. Follow the correct procedures.

- Repairs that can be made to sanders on the job are grinding and filing the clamps straight and replacing the rubber pad.
- Repairs to paint sprayers and texture machines are generally done at a repair centre.

EXERCISE

1. What are two main reasons for keeping hand tools square and straight?
2. Are your hand tools square and straight?
3. What type of file is used on trowels and knives?
4. What manuals are available for your taping machine? Read the maintenance section.
5. A thin coat of _____ will make a machine easier to clean.
6. True or False? Few things ever go wrong with a hopper.
7. List five repairs that can be made to a taping machine on the job.
8. If a cutter blade breaks, where would you look for a new one?
9. The cutter blade in the block should taper to the _____.
10. What tools are needed to replace a filler valve?
11. Assuming that all else is correct on the machine, what is the sign that the cable needs replacing?
12. When securing a new cable to the piston, where should the brass end of the cable be?
13. What must be done after putting a new tape feed needle in place?
14. True or False? When replacing a drive chain, the small chain sprocket must be taken off.
15. What are two things that can go wrong with angle rollers?
16. What are the two repairs that can be made to filling boxes on the job?
17. Where should the tabs of the rubber seals fit on a filling box?
18. What should be done when a sander can no longer get right into corners?



Estimating

MODULE 11

INTRODUCTION

There are two ways of estimating the materials, working time, and dollar figure for a drywall job: from blueprints and from the actual job-site. Blueprints are generally used prior to construction of the building to estimate the area (number of square metres) of wallboard surface in the building. Bids on drywalling jobs are often given according to estimates made from blueprints. Once the building is constructed the walls and ceilings can be measured and a more accurate estimate of the job can be made. This module describes blueprints then gives the methods of calculating drywall materials and working time from blueprints and form a job-site inspection. It is intended as an introduction to estimating for self-employed individuals or for foreman supervising crews.

Blueprints

A complete set of blueprints has two parts: the drawings and the specifications. Both are equally important when determining work procedures and material requirements. The blueprints are visual instructions on how a building is to be constructed. Information is drawn to scale, and materials are shown with symbols. The specifications detail work procedures, liabilities, specific information about materials, and any other information that cannot be hand-drawn. Unfortunately drywall is not shown on a separate drawing, and therefore you must sift through all the blueprint drawings to find complete information pertaining to drywall. There are five types of drawings: plot plan, floor plan, elevation, detail and section.

Plot Plan

The plot plan shows how the building is situated on the lot. It gives the geographical position according to the points of the compass, as well as the overall dimensions of the building and distances from the perimeter of the building to the edge of the lot. This is important in locating the area in the building where you will work, especially if the building is not yet built or if it is a large complex such as a shopping centre. Note that a plot plan is not the same as a survey plan. A survey plan shows only the legal description of the land upon which the building is situated.

Floor Plans

Floor plans are drawn for each floor in a building. A floor plan shows what a floor of a building looks like from above as if there is no roof or ceiling. Floor plans give the location, shape and size of the rooms. From floor plans the drywall estimator can get:

1. The area of the ceilings, if the ceilings are flat.
2. The length of the walls (note that you have to go to the elevation plan for the height).
3. Which way floor, and therefore the ceiling, joists run.

Elevation Drawing

The elevation plan shows the floors of a building from a side view. From the elevation plan the estimator can get:

1. The height of walls. You have to be careful with blueprint wall heights, though, because changes can occur when the actual walls are built.
2. The slope of the ceiling, if there is one.
3. How the stairwells are constructed.

Detail Drawings

Detail drawings are large-scale drawings that detail the finishing in certain areas of the building. They are drawn as if you are standing in front of the building looking straight in.

From detail drawings the estimator gets:

1. Special trims around windows, doors, skylights, elevator fronts; all factors in a drywall finishing job.
2. Any special panelling on walls. In otherwords, which walls aren't drywalled.

Section Drawings

Section drawings are detailed drawings showing the internal construction of certain areas of a building as if the surface had been cut to reveal what is behind it. From section drawings the estimator can get:

1. The type of framing: metal or wood.
2. The type and thickness of wallboard.
3. If the wallboard is attached directly to the framing or if special sound-reducing framing methods are used.

By combining the information from all five blueprint drawings you can piece together information about the drywall job and get a general picture of what the job is like.

Finish Schedules

Finish schedules are included in the blueprints and may be drawn as a grid, with the rooms on one axis and the walls, ceilings, floors, etc., on the other. The finish schedule tells you what material is on a surface and what kind of finish goes on the material. It is a general information sheet from which you can determine what areas are drywalled and what amount of drywall finishing is required to prepare the wallboard for its final decoration.

A finish schedule does not give specific information on finishes such as the color of paint or the thickness of a vinyl wall covering. This information is found in the specifications. See Module Eight for examples of finishing schedules.

Specifications

The specifications are broken down into headings to help you readily locate information. Not all architects will include a section on drywall in their specifications and even if they do have one, all the required information on drywall may not necessarily be there. A close reading of the specifications will be necessary to locate all information pertaining to drywall. As you read, it is a good idea to make notes listing all the headings that contain information regarding drywall. You may also find it helpful to underline or highlight pertinent information for quick reference.

Specifications can also be used to cross-check the architects' instructions. Be sure that when reading blueprints or specifications you make no assumptions. Read what is presented to you. If it does not make sense, for one reason or another, contact the architect for an explanation.

In addition to blueprint specifications it is necessary to have a working knowledge of specifications produced by government agencies, manufacturers and related trades. These must be compared to the architect's specifications so that any discrepancies can be noted and checked. Generally speaking, there is a hierarchy of specification with those above overruling those below. A typical hierarchy could be:

1. Local building codes
2. National building codes.
3. Architect's specifications.
4. Manufacturer's specifications.
5. Local drywall association's specifications.

The order of the hierarchy can change from job to job depending on such factors as the type of local government, the knowledge of the local engineering department, and the type of building and its source of funding. Mortgage company or national agency standards like CMHA and CSA can also effect the order. Be aware of the various specifications and their priority of importance.

Calculating Areas From Blueprints (Doing A "Take-Off")

To calculate areas you will need to use the formula for the area of a rectangle, Area = length times width. A calculator will save a lot of time. Flat ceiling areas are found by multiplying the length of the room by its width. Calculating some ceiling areas such as room one in Figure 11-1 is straight forward (3 m × 4 m = 12 m²). Other ceilings are more of a problem, e.g., room 5, the right angle hallway. No measurements are given for the hallway; you have to find them by looking at the measurements of the adjoining rooms. The vertical leg of the hallway is 3 m + 1 m = 4 m long and 1 m wide. The horizontal leg is 3 m by 1 m. The area of the hallway therefore is (4 m × 1 m) + (3 m × 1 m) = 7 m².

The areas of the ceilings in Figure 11-1 are calculated as follows:

Room 1. 3 m × 4 m = 12 m²
Room 2. 3 m × 5 m = 15 m²
Room 3. 3 m × 3 m = 9 m²
Room 4. 3 m × 3 m = 9 m²

Room 5. (4 m × 1 m) + (3 m × 1 m) = 7 m²
Room 6. 1 m × 4 m = 4 m²
Room 7. 4 m × 7 m = 28 m²
Ceiling total = 84 m²

As you read these figures you may be wondering what consideration has been given for the width of the walls in the closets, bathroom, ensuite, and hallway. To get such accuracy you would need a much more detailed drawing. Given the scale of Figure 11-1 the walls can be considered insignificant. On a much more detailed drawing, however, they would be significant.

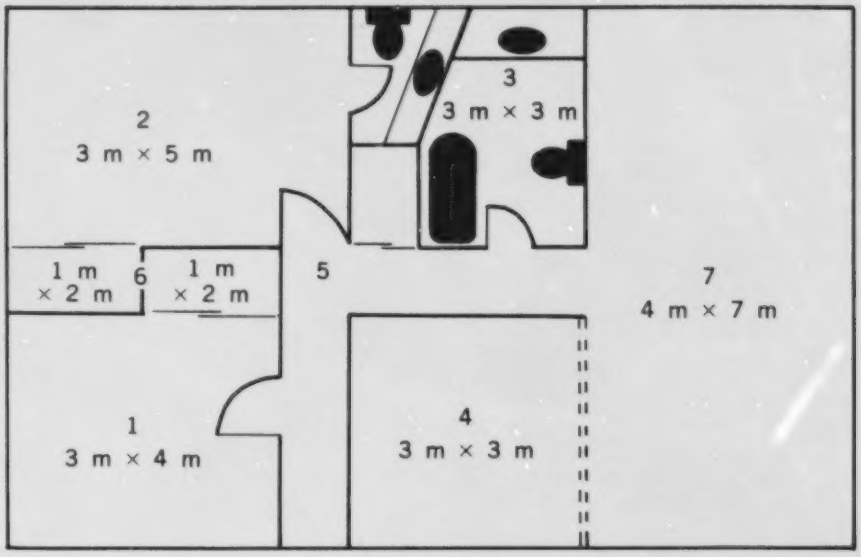


Figure 11-1
Floor Plan

The area of the walls can be found by adding the length of all the walls in a room and multiplying the sum by the height. In this case, assume that the walls are 3 m high. The area of the walls in room one is 3 m + 3 m + 4 m + 4 m = 14 m × 3 m = 42 m².

You may find that some walls, rooms, areas, and floors are identical. These are called typical areas. You must be careful to ensure that these are truly identical areas, not just similar. Typical areas speed up the estimating procedure because you can find the area of one and multiply it by the number of typical areas.

Calculating as above from blueprints is called a take-off. A take-off requires careful inspection of blueprints for dimensions. If dimensions are missing they may be calculated from other dimensions given on the drawing. If this cannot be done, contact the architect or use a scaling ruler to determine the missing dimensions. However, when using a scaling ruler, be aware that paper will stretch or shrink, and in small-

scale drawings the width of a line can make quite a difference in your estimate. One thing you can do to check the accuracy of the drawings is to measure several lines that have their dimensions marked, and note the amount of error. From these you can calculate an average percentage error and use it to correct your scale measurements. To be safe, though, if a dimension in question is critical to the estimate, contact the architect.

When doing a take-off, organize your work so that you do not miss anything or do a room twice. List all the rooms in the building on one side of a sheet, and list the dimensions beside each room. Always write down as many of your calculations as possible and keep them at hand. It is not necessary to write all your calculations on the take-off sheet, but it is good practice to have them at hand for checking your work. In this way you will avoid having to go over the whole drawing again because of a mistake for example in your addition.

In summary, blueprints can be used to calculate the area of wallboard for a building and thus can be used to get a general cost estimate of the job.

Estimating From The Job Site

Making A Board Count

It is not a good practice to use the blueprints to calculate the size of the sheets of wallboard required to do the job. While the blueprints are a drawing of what the architect perceives the building will look like when it is finished, there are usually some changes made during construction. Walls may be changed, added, or removed. For example, in several rooms the blueprints may state that the walls will be 3 m, but the actual wall measurements turn out to be 3100 mm. This means that you will not be able to use 3000 mm sheets as the drawings indicate, but will have to use the next longest sheet, which is 3600 mm. The extra material in a large project can make quite a difference in the cost of a job.

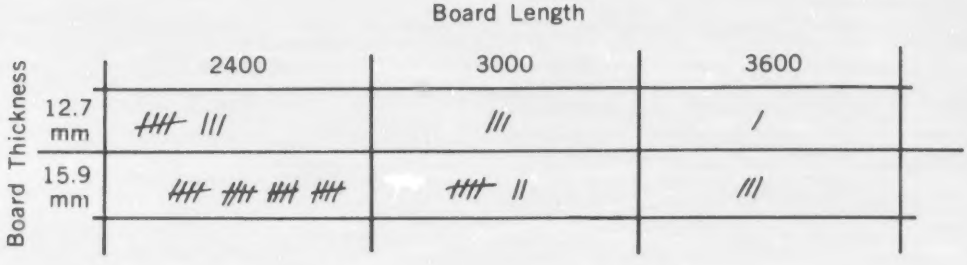


Figure 11-2
Board Count

Measuring the building for wallboard is called doing a board count. You will need a 5 m tape and paper to record the count for the different lengths and thicknesses of wallboard. Draw a grid as shown in Figure 11-2. As you measure a wall or ceiling note the size of the sheet required by a single stroke in the appropriate column on the grid. To simplify totalling the sheets, group the strokes in fives.

While measuring, you must keep in mind how many joints will be required to cover a wall, where they will be placed for structural strength, and where they can be easily filled and hidden. Some basic rules to keep in mind are:

1. Keep butt joints as close as possible to the end of the walls.
2. Butt joints should be staggered a minimum of two studs.
3. Keep butt joints away from the middle of the ceiling.
4. Don't have butt joints lined up with a light source.
5. Walls that are 1200 mm or less should have no horizontal joints.
6. When possible, there should be no joints above doorways or horizontal joints.
7. If a joint is necessary above or below an opening it should be a minimum of 300 mm from the corner.
8. Butt joints should not be made where an external wall corner meets the ceiling.

Establish a system for measuring a building. One good way is to measure a complete room, walls and ceilings, before moving on to the next, and to move clockwise through the building.

The most important factor is that you don't miss anything. As a quick check you can use this rule-of-thumb: multiply level-entry floor areas by 3.5 and the answer should be within 20-30 m^2 of your board count. For cathedral-entry buildings, multiply the floor area by 4 to get a rough answer. This method should not, of course, be used to calculate a firm contract price.

If several people measure the same building, most likely they will come up with different board counts, thus different estimates of materials and costs. These counts and estimates should, however, be within 10 per cent of one another unless someone has made a major error in calculations or measurements.

Figure 11-2 shows that you would have a total of eight 2400 mm sheets of 12.7 mm board and 2400 mm sheets of 15.9 mm boards. Thus, when ordering the wallboard, you would specify:

15.9 mm:	20 – 1200 × 2400	7 – 1200 × 3000	3 – 1200 × 3600
12.7 mm:	8 – 1200 × 2400	3 – 1200 × 3000	1 – 1200 × 3600

You would not combine the 15.9 mm and 12.7 mm totals for each length because there is a difference in cost. You would, however, add them together to find the total area of wallboard in the building.

Calculating Corner Beads and Trims

Corner beads and trims can be bought in 2100, 2400, 3000, and 3600 mm lengths. Every external corner requires a corner bead. Closets that are returned or have a 10 mm overlap will require J-bead on the front and corner bead inside. Plastic J-bead is required around windows that are returned. Metal L or J-bead or plastic J-bead is used to finish the edge of wallboard that abutts another surface such as brick or concrete. On larger projects this information will be found in the specifications. On housing projects the builder will supply the information.

When measuring bead, always use the length that will create the least amount of waste. For example, if you are measuring archways, you will need four 2100 mm beads for the

uprights. If the width of the archway is 1050 mm, one 2100 mm bead would cover both headers. You must think ahead as to where the cut pieces can be used.

Calculating Filler and Tape

When calculating the amount of filler needed in a building, use the area derived from the board count, since it governs the number of joints that will be in the building. Also use the total length of bead required.

Use the following guidelines for determining the amount of materials:

110 m of tape per 100 m^2 of board (1 roll of tape has 150 m)
1 box of 2 bags of taping filler per 100 m^2
1 box or 1 bag of topping filler per 100 m^2
2 boxes of pre-mix filler per 100 m^2
2 bags or 1 box of pre-mix filler per 30 m of bead
3 bags of all-purpose filler per 100 m^2
5 L of paint per 30 m^2
1 bag of texture per 30 m^2

For example, if you have 450 m^2 of wallboard with 90 m of bead you would require:

1. $\frac{450\ m^2}{100\ m^2} \times 110\ m = 495\ m \qquad \frac{495\ m}{150\ m/roll} = 3.3$ rolls of tape.

2. $\frac{450\ m^2}{100\ m^2} \times 1$ box $= 4.5$ boxes of taping filler.

3. $\frac{450\ m^2}{100\ m^2} \times 1$ box $= 4.5$ boxes of topping filler.

4. $\frac{90\ m^2}{30\ m^2} \times 1$ box $= 3$ boxes of filler for bead.

   or, if you were using all-purpose filler:

   $\frac{450\ m^2}{100\ m^2} \times 3$ bags $= 13.5$ bags of filler.

Naturally you cannot buy 3.3 rolls of tape or 4.5 boxes of filler. Therefore you must round off to the next nearest whole number.

Other Factors When Costing A Job

It has been a common practice in the drywall trade to charge the customer the same amount for materials that the contractor pays for them. This can create a problem because the government will probably try to charge the contractor sales tax on the materials assuming that according to normal business practice they will have been marked up.

The amount of work that one finisher can do is dependent upon many factors, and may vary from one job, crew, or season to the next. Workers or companies should keep a record of the type of job and the hours worked to get an accurate time-count for each task. Generally, assuming a hopper or taping machine is used, it takes 7.5 hours for one drywall finisher to completely finish 100 m^2 of wallboard. This includes approximately 90 m of bead. However, conditions such as high walls, odd shaped rooms, and sloped ceilings can reduce this output by as much as 50% or more. Hidden costs and overhead can drastically affect the final contract price of a job, and will vary from one company to another. Hidden costs are costs created by certain job site conditions or procedures, and cannot be determined from the take-off. Examples of hidden costs are: supervision, moving on and off the site, protection of materials and finished work, and even the cost of running the job due to the general contractor. You cannot accurately predict these costs, but a certain percentage of the total known cost must be allowed for them in your price.

Overhead is the cost of keeping a business running, including office rental, business licences, office help, telephone bills, etc. Overhead is usually calculated on a yearly basis and converted to a percentage based on the company's income. This percentage is then added on top of each contract price.

Everyone involved in drywall makes estimates, whether it be how much to bid for a drywall job in a large apartment or how much filler to mix for taping. Estimating is part of the job.

SUMMARY

- Drywall finishers must read five types of blueprints.
- Blueprints must have a set of specifications to be complete.
- Specifications are equally as important as the drawings.
- Any discrepancies between the drawings and the specifications must be resolved with the architect.
- A scaling ruler should not be used to arrive at dimensions from a drawing without determining the accuracy of the scale of the drawing.
- Architect's specifications must be compared to those of other regulatory agencies for congruency.
- Check for typical areas.
- Calculate ceiling areas.
- Calculate wall areas.
- Combine wall and ceiling areas for total area.
- Make a board count.
- Calculate bead and trims.
- Calculate filler, tape, texture.
- One drywall finisher should complete approximately 100 m^2 of wallboard in 7 1/2 hours assuming normal conditions and the taping is done by machine or hopper.
- Rule-of-thumb for estimating wall and ceiling areas:

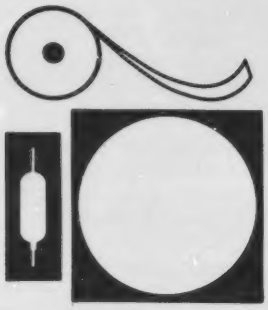
  level-entry: floor area times 3.5

  cathedral-entry: floor area times 4

- Contractors must take into account hidden costs when bidding on a job.

EXERCISE

1. What are the three types of documents that contain information about drywall?
2. What is the difference between a take off and a board count?
3. Using the formula for rough estimating, calculate the approximate amount of premix filler for a cathedral entry house with a 120 m^2 floor area.
4. If it takes 7.5 hours to finish 100 m^2 of board, how long will it take to finish an apartment block that has 6000 m^2 of board?
5. a. Calculate the total area of wallboard for the house shown in Figure 1-1.
   b. Calculate the amount of material required to tape and fill the house (exclude beads).
   c. How much paint will it take to undercoat all the ceilings including the closets and bathrooms?
6. How much texture would you need to do all the ceilings including the closets and bathrooms?
7. How do walls and ceilings higher than 2400 mm affect output?
8. List some hidden costs you have encountered on a job.
9. Every six months record your m^2 output for 7.5 hours work.



Answer Key

MODULE 1

1. So that they can cut through the filler.
2. False. Fillers are formulated to meet regional conditions and needs.
3. Filler, binder, binder modifiers, additives.
4. Binder: internally binds the filler together and externally bonds it to the wallboard.

   Additives: give the filling compound desired performance characteristics.
5. Taping filler: high shrinkage, good bond, hard when dry, finish not smooth.

   Topping filler: low shrinkage, weak bond, fairly soft when dry, smooth finish.
6. a. It sets quickly.

   b. Deep fills will have little shrinkage or cracking.
7. Prefilling.

   Taping small jobs.

   Making deep fills.
8. Free water in the filler.

   Water combined with the limestone.

   Water combined with the binder.
9. Because the two fillers could be incompatible and produce a defective filler. Besides, manufacturers' warranties are void when fillers are mixed.
10. a. 200-300 rpm.

    b. 450 rpm.
11. To improve the workability, flexibility, and crack resistance of the filler.
12. False. Filler is added to the water.
13. 48 hours.
14. The surface of the filler tears.

MODULE 2

1. 12.7 cm diameter.
2. The maximum height of a free-standing scaffold is 3 × minimum base dimension.

   The maximum height for remaining on a moving scaffold is 2 × minimum base dimension.

Answer Key

The maximum height for remaining on a scaffold while moving it yourself is 1.5 × minimum base dimension.

3. The mask should have a NIOSH, MESA or U.S.A. Bureau of Mines approval number for pneumoconiosis producing dusts.
4. Set standards for safe working conditions.

   Provide benefits for injuries.

   Inspect job sites.

   Rehabilitate injured workers.
5. Bursitus, tendonitus and back injuries.
6. Electrical shock.

   Injury caused by a drill trigger sticking and jumping out of your hands.
7. When working below a scaffold.

   When entering or leaving a job site.
8. Trying to maintain production speed while in awkward positions causing strain on muscles and joints.
9. Use a pushing motion when ever possible.

   Keep your arm close to your body.

   Use stilts or scaffolds, don't stretch.

   Bend your knees, not your back.

MODULE 3

1. Advantages:
   - Fast to apply
   - Smooth finishing edge.

   Disadvantages:
   - Paint chips off the finishing edge.
   - Can be damaged by bumping.
   - Is affected by movement in the framing.
2. Advantages:
   - A good bond for the entire length of the bead.
   - Is not affected by movement in the framing.
   - Is not easily damaged by bumping.

   Disadvantages:
   - Difficult to apply.
   - The finishing edge can be damaged during filling.
3. L-bead: used to trim the rough edges of a long run of wallboard.

   J-bead: used to trim edges when there is no backing to nail or screw to. The edge should be no longer than one length of J-bead.

   Plastic J-bead: used as a vapor barrier where wallboard abuts aluminum window frames.

   Veneer bead: used when a corner must be plumbed or straightened.

   Flexible: used on external and internal angles that are greater than 90°.
4. 2385 mm.
5. So the finished bead will have a continuous line.
6. Slightly less than 45°.

7. Chalkline.
   Straight edge.
8. The flange must be cut to allow the bead to bend. The closeness of the cuts depends on the diameter of the circle.
9. Midway up the bead.
10. Double fasten the ends.
11. 15 cm to 20 cm.
    3 cm.
12. Bowed in: at both ends.
    Bowed out: at the furthest point out on the bow.
13. Pan and knife.
    Hopper.
    Corner tool and roller.
14. The wet paper can easily burr or tear.
15. To keep the bead straight.

MODULE 4

Hand Taping

1. To reinforce joints and provide a solid, flat surface for further coats of filler.
2. Paper tape is 5 cm wide, cream colored, spark-perforated, creased down centre, and buffed on the edges on one side.
3. For patching jobs and on non-bearing, steel-stud walls.
4. a. Butts.
   b. Flats.
   c. Short tapes
   d. Angles.
5. The tape may be pressed in too far in places to wipe a smooth arc.
6. a. Within 1 cm of the ends of joints.
   b. Over the flange but not over the finishing edge.
   c. Within 1 cm of the floor.
   d. Tight in threeways. Threeway tapes cannot be short.
   e. Do not cut the tape. Run it right overtop of the outlet.
7. For small jobs and for confined areas.
8. Run your finger through the filler to make a trough. The filler should immediately flow to fill in the trough leaving only a slight depression.
9. Butts, 2 mm.
   Flats, 3 mm.
   Angles, 2 mm.
10. b.

Answer Key

11. To cover holes.
    To repair damaged wallboard around fasteners.
    To cover gaps around electrical boxes and plumbing pipes.
    To reinforce corners in archways.
    To reinforce J-bead.
    To bridge gaps between bead and wallboard.
12. Two.
13. 3 mm.
14. Make a sharp crease in the tape before laying it into the angle.
15. False. It should be just slightly more.
16. The tape and filler are put on the wall in one step.
17. Advantage: The hopper holds more filler and therefore more tape can be put on between refills.
    Disadvantage: Stilts are needed to do the upper part of the room.
18. True.
19. To adjust the amount of filler on the tape.
20. Press the handle of a knife, your fingers, or the side of your hand down the crease mark as the tape is laid into the corner.
21. The bottom tape should overlap the upper tape to reduce the likelihood of the tapes being pulled off.
22. The end of the tape has not been pressed tightly against the ceiling wallboard.
23. With the hopper, the tape with filler on it is carried to the wall in a pail. With the banjo, the tape is applied directly to the wall from the banjo.

Machine Taping

1. All taping can be done from the floor.
   It is a clean method of taping.
   The production rate is high.
2. Cost of purchase or lease.
   It is awkward in confined areas.
   It requires training to use it proficiently.
3. Taping machine, 3 pails, loading pump with a gooseneck attachment, hand knifes, roller, flusher.
4. A screen can plug and it takes time to unplug it. A screen is not necessary because lumps in filler will pass through the machine without a problem.
5. Do not remove the pump from the pail, but rather pour filler into the pail.
   Make sure filler is present at the outlet of the gooseneck before pumping filler into the machine.
6. To soften any dry filler so that the parts move freely.
7. From the bottom of the roll to the head of the machine.
8. That the blade is either dull or broken.

9. So that no filler will flow out of the head of the machine.
   So that the drum, cable, and plunger roll freely during filling.
10. 9 to 11 pumps.
11. a. By poking inside the nozzle with a nail or piece of wire.
    b. If that doesn't work, by taking the valve out and cleaning it.
12. Butts on the ceiling, butts on the walls, flats on the ceiling, flats on the walls, short tapes and angles.
13. a. Turn the winding key a few turns.
    b. Run a horizontal wall flat, or if one is not available, an upper butt or a vertical flat.
14. Immerse the head in a pail of water.
15. So that you can start the tape exactly where you want it.
16. Only for the first 15 cm, then just one wheel should touch.
17. To compensate for dragging of the tape along the joint.
18. 6 cm.
19. The tape will be cut on an angle or the blade will jam.
20. Pull the machine back a bit then ahead to the end of the joint, simultaneously pushing the collar forward to advance the tape.
21. The winding key is on the right hand side of the head. If the left hand is on the collar when taping angles, the winding key will jam against the wallboard.
22. To keep the filler flowing onto the tape.
23. The left hand, the hand not on the collar.
24. Between 45° and 60°.
25. You can run the machine with only your left hand on it.
26. The machine should bisect the angle.
27. Creasing wheel, peel off.
28. Immediately after washing when the machine won't be used for a while.
29. Because such courtesies contribute to better teamwork and thus better production.

Wiping Tapes

1. A fairly wide knife of at least 17 cm with a long handle.
2. By wiping tapes in two directions starting at a point between the two ends of the tape.
3. The pressure applied to the knife and the angle of the knife to the wallboard.
4. The tape should be peeled back, filler should be applied, and the tape should be rewiped.
5. A properly wiped tape should:
   Be centered on the joint or hole.
   Have no wrinkles.
   Be tight to the surface.

Answer Key

Have a skim coat of filler on top.
Have feathered edges.

6. The wiper.
7. Apply filler to both the top of the wiped side and underneath the side to be wiped.
8. Because it is easy to apply too much pressure and leave a dry tape.
9. At least 3 cm.
10. More than 60 cm.
11. 12 cm.
12. Wipe the top half of each side of an angle in one direction, then the bottom half of each side in the opposite direction.
13. The angle will crack where the paper is torn.
14. They should bisect the angles.
15. The tape will dry and bunch up in the angle.
16. The tape will be pushed off to the left.
17. 8 cm.
18. Wipe the angle with a knife.
19. 1 cm.
20. To watch for scratches, loose filler, unfeathered edges, unfilled fasteners, or defects in the wallboard up to the 1200 mm point on the wall.
21. 3 strokes. Starting from the centre of the threeway:
    a. Left across the ceiling.
    b. Down the left wall.
    c. Across the right wall.
22. 3 strokes on each side of the angle:
    a. Apply a thin coat of filler.
    b. Wipe the tape tight.
    c. Feather the edge.
23. The roller is difficult to keep in the centre of the tape. There is usually a gap in the joint and the roller forces the tape into the gap and accentuates the problem.
24. Whether any cabinet or trim will be put into the angle.
    That no more than 5 mm of filler will be necessary on top of the tape.
25. Use a straight edge.
    Use flexible bead in the angle.

MODULE 5

1. Fast-setting filler.
2. Taping filler is harder to sand and may contain harmful fibres.
3. The filling of problem areas before taping or filling begins.
4. Pre-filling prevents uneven shrinkage that would require an extra coat to fill.
5. a. Gaps more than 5 mm.

b. Uneven board surfaces.
c. Loose paper, holes around electrical outlets, and plumbing pipes.
d. Broken board around fasteners.
e. Nails in joints.

6. a. Beads — close to the finishing edge.
b. Butts — on either side of the tape.
c. Flats — in the middle of the joint.
d. Angles — in the apex of the angle.

7. a. By sight.
b. By touch.
c. With a moisture meter.
d. From drying charts.

8. Fasteners — 3
Flats — 2
Butts — 2 or 3
Angles — 1
Bead — 3

9. Fasteners — 2
Flats — 1 or 2
Butts — 2
Angles — 0 if wiped properly
Bead — 2

10. Powdered: overfill to compensate for shrinkage.
Pre-mix: level fill.
Fast-setting: leave hollow to compensate for expansion.

11. The fill should be narrow and not be rippled or ridged. Small air holes (pin holes) are acceptable.

12. The fill should be smooth, wider than the first coat and blemish-free.

13. It should be very smooth or slick to the touch, have no blemishes, and should completely cover the second coat.

14. To seal off the wallboard, to remove minor imperfections, and to equalize the suction of the wallboard.

15. When a highly reflective decoration is to be used or when a light source is to shine across the wall.

16. A uniform hazy, white appearance with all previously filled areas visible as a more solid white.

17. Control and pressure.

18. Knuckles to the ceiling.

19. a. Loading.
b. Feathering
c. Removing the excess

Answer Key

d. Cleaning the finishing edges (beads only).

20. Decreased . . . . . .increased.
21. To blend the edges of the filler into the wallboard.
22. Smooth.
23. The fill should be rough sanded.
24. Top angles, threeways.
25. By arcing it off towards the finishing edge of the bead.
26. Gravity pulls the filler into hollow spots.
    Filler is less likely to fall on the floor.
    It is easier on the body to pull upwards.
27. The low side must be built up with filler.
28. If possible, try to go around the opening without removing the blade from the wall. Pivot the blade at the corners.
29. On flat surfaces the joint should be flat, whereas on curved surfaces they should be curved.
30. Load the joint so that the low side is built up while very little fill is applied to the high side.
31. Butt: 60-75 cm.
    Flat: 30 cm.
32. Too much filler has been removed from the flat.
33. Adjust the blade, or if that doesn't work, replace the blade.
34. First coat — 25 cm box.
    Second coat — 30 cm box.
35. As soon as you apply pressure start moving the box.
36. The hand closest to the box acts as a fulcrum while pressure is applied by pulling down on the end of the handle with the other hand.
37. Three.
38. First coat — 13 cm knife.
    Second coat — 15 cm knife.
    Third coat — 18 cm knife.
39. Smooth finish:
    First coat — 5 cm box.
    Second coat — 5 cm box.
    Third coat — 8 cm box.

    Textured Finish:
    First coat — 5 cm box.
    Second coat — 8 cm box.
40. To give an adequate width of fill for the 8 cm sander.
41. A maximum of 1 mm.
42. True.
43. False. The bottoms and threeways are always done by hand.
44. Place a straight edge along one side of the angle the width of the knife away from the angle, and run the knife along the edge. Repeat on the other side of the angle.

45. Approximately 3 mm.
46. Take the back off the box.
47. a. Vertical angle.
    b. Fasteners.
    c. Butts
    d. Top angle.
    e. Flats.
48. Depending on the finish to be applied, a 200 W, 150 W, or 100 W bulb in a light extension cord.

MODULE 6

1. Hard — walls.
   Soft — ceilings only but not ceilings in high humidity rooms.
   Self-priming — all ceilings.
2. Immediately after the texture is sprayed on.
3. False. They require a similar preparation.
4. So that the design can be centered on the surface.
5. Warm colors tend to stimulate, whereas cool colors tend to relax.
6. Mix a large, single batch or blend several small batches together.
7. Because the masking tape on the paper apron won't stick to the dusty angle.
8. Half the width of the tape.
9. With staples.
10. It must have a flat finish, must seal the surface, and must cover (hide) the entire surface.
11. It will disperse the binder and pigment and decrease the seal and covering ability.
12. Painting the angles with a paint brush before the surface is painted with a roller.
13. Never point the gun at yourself or at anyone else.
    Lock the trigger when the gun is not in use.
    Release the pressure in the line when the gun is left unattended.
14. Turn the trigger on and off while your hand is moving.
15. The paint will be blocked and the pressure will blow the packing out of the tips.
16. Machine Factors:
    Air pressure.
    Size of orifice.
    Thickness of texture.
    Application Factors:
    The distance of the orifice to the surface.
    The angle of spray.
    The speed at which the orifice is moved.
17. True.

18. When the texture looses its shine and turns dull.
19. Evenness of spray is very important as any variation is easily seen.
20. Run a knife along the angle.
21. Built-up textures, one-coat finishes, staple patterns.
22. 5 mm.

MODULE 7

1. The filler shrinks at the same rate and no further work needs to be done.
2. To soften the film on the filler being repaired so that pulling does not occur.
3. True. If you sand parallel to the ridge.
4. 5 cm hole — laminated tapes;
   12 cm hole — glued wallboard patch
   20 cm hole — wallboard patch screwed to backing.
5. To ensure a good bond between filler and the painted surface.
6. False. The ridged tape if not firm will have to be cut out and the joint prefilled, taped and filled.
7. Press the wallboard tight to the framing.
   Reset the fastener or apply a new fastener.
   Refill with three coats.
8. Plaster has a low Ph and will burn the binder in slow-setting filler. Fast-set acts as a buffer between plaster and slow-set.
9. If texture has been removed, it should be scraped. If texture is discolored, it can be repainted.
10. Feathered.
11. The sealer should dry fast and prevent the stain from bleeding through.
12. PVA — smoke damage.
    Lacquer — water soluble stains.
13. The framing is not straight or the plaster is loose.

MODULE 8

1. The type of floor, whether there is a base trim, the type of wall finish (flat paint, gloss paint, wallpaper, vinyl paper, tile), whether the ceilings or walls are to be textured, whether there is a dado.
2. Closer attention to the surface preparation must be made for gloss paints than for flat paints.
3. The lower the humidity the faster the drying time.
4. Nail pops, delayed shrinkage of filler, wallboard bulges and cracks.
5. 12°C.
6. Ventilation.
7. If the temperature is significantly lowered, the surface of the filler could dry but the underneath could still be wet. If the temperature rises significantly the filler could fail to bond properly.

8. Studs out of alignment, out of plumb walls, soft studs, studs and plate not aligned, stud centres too far apart to support the board, undersized framing for drops and valences.
9. Spaces between joints, rippled beads, fastener beads above the surface of the board, uneven joints, broken core, loose face paper, improper joints (i.e., floating butt joints), cracked face paper, gouges, oversized holes for outlets and pipes.
10. No more than 1 m is recommended.
11. Coat the stain with lacquer or a spray-bomb varathane plastic.
12. Run a knife along the edge of the tape to cut any overlapping filler so that the tape does not lift off filler from the wall when it is removed.
13. The written specifications.
14. 15%.
15. 40% — 70%.
16. 24 h.
17. A light box and switch and outlets no less than 1.8 m apart on useable wall surfaces. All electrical boxes should have wires fed into them.

MODULE 9

1. Have tools and equipment on the job when they are needed.
   Order the right materials in efficient lengths and quantities.
   Have the crews organized efficiently.
   Have an efficient work system.
2. Visually check your work in the reverse order in which it was done.
3. 4 persons. Since one person can coat 1 house in a day, then 4 persons could coat the 4 houses in 4 days.
4. a. Tape, and first coat bead and fasteners.
   b. Second coat all fasteners, bead and tape
   c. Polish coat.
   d. Texture ceilings and sand the walls.
5. Individual approach: good quality work but likely to be slower than the team approach.
   Team approach: high production but the quality may not be as good as the individual approach.

MODULE 10

1. You produce a better job in less time.
2. Check that your hand tools are straight and square.
3. Single cut mill bastard file.
4. Read the maintenance section on your taping machine owner's manual.
5. Oil.
6. True.

Answer Key

7. Replace the:
   Cutter blade.
   Filler valve.
   Cable.
   Feed needle.
   Drive chain.
8. In the bottle of spare parts in the tape holder.
9. Right.
10. Screwdriver, hammer, piece of wood or plastic.
11. Filler will not flow onto the tape when the drive wheels are turned.
12. Beyond the nut.
13. The needle must be adjusted so that it penetrates through the tape with the needle at mid-point in the advance position.
14. True.
15. Roller bushings wear out and plastic rollers can develop flat spots.
16. Replace the blade.
    Replace the rubber seals.
17. The slot in the back of the back plate.
18. Replace the rubber pad.

MODULE 11

1. Blueprints, finish schedules, specifications.
2. A take off determines the area of wallboard in a building, whereas a board count determines the number of sheets by length and thickness.
3. The cathedral entry house has approximately:
   $4 \times 120\ m^2 = 480\ m^2$ of wallboard.

   There are 2 boxes of pre-mix filler per 100 m^2 of wallboard.

   $\frac{480}{100} \times 2 = 9.6$ or 10 boxes of pre-mix.

   Remember the 10 boxes is approximate.
4. $\frac{6000}{100} \times 7.5 = 450$ hours.

5. a.

Room No.	Walls		Ceilings	
1	(3+3+4+4) 3	= 42 m²	3 × 4	= 12 m²
2	(3+3+5+5) 3	= 48 m²	3 × 5	= 15 m²
3	(3+3+3+3) 3	= 36 m²	3 × 3	= 9 m²
4	(3+3+3) 3	= 27 m²	3 × 3	= 9 m²
5	(4+3+4+3) 3	= 42 m²	(4×1) + (3×1)	= 7 m²
6	3(1+1+2+2)+(1+1+2+2) 3	= 36 m²	(1×2) + (1×2)	= 4 m²
7	(3+3+4+7+4) 3	= 63 m²	4 × 7	= 28 m²
	Sub Total:	294 m²		84 m²

Total: 378 m²

b. $\frac{378}{100} \times \frac{110}{150 \text{ m/roll}}$ = 2.77 or 3 rolls of tape.

- bags of taping filler.

  $\frac{378}{100} \times 2 = 7.56$ or 8 bags.

- bags of topping filler.

  $\frac{378}{100} \times 1 = 3.78$ or 4 bags.

- bags of all-purpose.

  $\frac{378}{100} \times 3 = 11.34$ or 12 bags.

- boxes of taping filler.

  $\frac{378}{100} \times 1 = 3.78$ or 4 boxes.

- boxes of topping filler.

  $\frac{378}{100} \times 1 = 3.78$ or 4 boxes.

c. Paint.

$\frac{84}{30} \times 5 = 14$ L of paint.

Answer Key

6. Texture:

   $\frac{84}{30} \times 1 = 2.8$ or 3 bags of texture.

7. Walls and ceilings above 2400 mm can increase the finishing time by 50% or more depending on the height.
8. Examples of hidden costs:

   Lack of heat, water, power.

   Having to move from one area to another.

   The work of preceeding trades is not completed.

   Breakdowns.
9. Your output should continue to improve for about the first three years, then level off.